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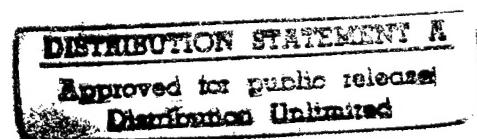
# ***JPRS Report***

# **Science & Technology**

***Central Eurasia:  
Electronics & Electrical Engineering***

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# Science & Technology

## Central Eurasia: Electronics & Electrical Engineering

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### Fax-Modem Communication

937K0142A Moscow RADIO in Russian No 3, Mar 93  
pp 2-3

[Article by G. Ivanov, Moscow]

[Abstract] This article provides an overview of the equipment used in fax-modem communication, including scanners and laser printers. Differences between a modem and a fax-modem are outlined. Current standards are discussed. The role of software in fax communication is described, and BitFAX and WinFAX are mentioned. The differences between the transmission of text and images is explained and the limits of OCR are discussed. The use of electronic mail is described.

### The Radio Market—Two Years Later

937K0142B Moscow RADIO in Russian No 3, Mar 93  
pp 4, 25

[Article by S. Smirnova, Moscow]

[Abstract] Two years ago, a consumer electronics exchange market opened. It had been prohibited by law before this time. In two years, the market has gone from very humble beginnings to a burgeoning business catering to more than 20,000 electronics enthusiasts. The market now offers consignment and testing services for televisions, recorders, and other equipment. The market also now has its own publication including "wanted" and "for sale" columns, as well as articles on recent innovations in electronics. Space at the market is sold at auction and anyone selling defective goods forfeits his spot. The author questioned some dealers to find out where their merchandise came from. Some have bought directly from enterprises, others buy from distant electronics stores. Attempts have been made to keep admission and space rental prices down, and recently door prizes for customers on certain days has been added. There is only one such market, and the reasons for this are explored. A twist in the story was the arrest of Anatoliy Prisyazhnyuk, the director of the market, who is charged with illegal collection of fines (from traders who broke market rules). His arrest, imprisonment until trial, and confiscation of business papers threaten the existence of the market.

### Radio Measurement Devices: Oscilloscopes

937K0140A Moscow RADIO in Russian No 12, Dec 92  
pp 46-48

[Article by O. Starostin, Moscow]

[Abstract] Among the 47 listed oscilloscopes available for radio amateurs there are two OML models, one "SAGA" model, forty four S1 high-speed models (including models S1-85, S1-108, S1-115/1, S1-117, S1-117/1, RS1-02 with digital readout and the RS1-01 oscilloscope-multimeter), six of the latter (S1-55, S1-69, S1-96, S1-102, S1-103, S1-115/1) having two beams.

Selection of the appropriate oscilloscope for a given application is determined primarily by the kind of signal to be measured. General-purpose oscilloscopes are used for displaying the waveform and measuring the basic parameters of most continuous signals. Storage oscilloscopes are used for recording and analysis of solitary and slowly repeating pulses. Stroboscopic oscilloscopes are needed for high-frequency signals and fast processes. The essential characteristics of an oscilloscope to be considered in the selection are: 1) accuracy class, 2) sensitivity, 3) maximum permissible voltage swing, 4) passband of vertical deflection channel  $\Delta f = f_u - f_l = f_u$  (lower cutoff frequency  $f_l$  either zero with open input terminals or 1-10 Hz only with closed input terminals,  $f_u$ -upper cutoff frequency), 5) scanning speed of horizontal sweep generator. Deviation of an oscillogram from the actual signal waveform is attributable to four error components: inherent instrument error, additional error due to departure of ambient conditions from standard ones, dynamic error, and energy error due to power drain from the signal source. The sensitivity of an oscilloscope is defined as the amplitude of the smallest signal whose parameters can be measured, the maximum sensitivity depending on the input attenuator and being defined as its smallest scale division. Decreasing the sensitivity of an oscilloscope by increasing the transfer ratio of its input attenuator makes the instrument suitable for measurement of larger signals, as long as the signal voltage must not exceed the maximum voltage permissible across the vertical deflection plates. The transient response characteristic of an oscilloscope must satisfy certain requirements for distortionless display of pulses: its rise time  $t_r$  must be at least three times shorter than the duration of a sinusoidal incoming pulse, at least five times shorter than the duration of a rectangular one, and at least ten times shorter than the duration of a triangular one. An oscillator must then be selected with a vertical deflection channel whose passband is  $\Delta f \approx 0.35/t_r$  ( $\Delta f$  in MHz,  $t_r$  in  $\mu s$ ) and has a horizontal sweep generator whose scanning speed corresponds to the duration of incoming pulses. For synchronization of an oscilloscope with the external signal source, it is important to use a synchronizing signal of appropriate voltage level and polarity. With each of the 47 oscilloscopes are listed its passband (MHz), input resistance (M $\Omega$ ), input capacitance (pF), vertical deflection scale factor (V/div), horizontal sweep scale factor ( $\mu s/div$ ), screen size, overall dimensions, and weight. Figures 1; tables 1.

### Review of the Book by O. K. Kushch "Optical Computer Aided Design of Illuminating and Irradiating Devices"

937K0139A Moscow SVETOTEKHNIKA in Russian  
No 12, Dec 92 p 21

[Article by A. A. Korobko; UDC 628.94.001.24]

[Abstract] A review is made of the book by O. K. Kushch "Optical Computer Aided Design of Illuminating and Irradiating Devices" A new approach is proposed in this



book to describe the fundamentals of theory and design of light devices. Based on powerful mechanism of linear algebra and differential geometry, this approach allows to effectively formalize the fundamental design procedures and, using the contemporary computer technology to obtain numerical solutions of most practical problems. The book contains a foreword, three chapters and bibliography. Elements of linear and matrix algebra and surface theory are described in the first chapter. The second chapter is dedicated to the description of methods for designing the light distribution of the illuminating and irradiating devices, that is the solution to the direct problem. The bulk of this chapter deals with the "reverse beam" method, which is the author's favored subject. Problems related to the solution of the reverse problem are included in the third chapter. In general, the monograph creates a favorable impression. The material is described in a contemporary mathematical language, and is illustrated by many examples.

#### **Illumination Products at the International Electrotechnical Exhibition "Electro-92"**

937K0104A Moscow SVETOTEKHNIKA in Russian  
No 10, Oct 92 pp 1-7

[Article by V. N. Stepanov; UDC 628.9:061.4]

[Abstract] An international exhibition of "Electrotechnical Equipment and Power Lines" - "Electro-92" was held in Moscow between July 21-29. The exponents included: general industrial electrotechnical equipment for generation and transmission of electrical energy, for mining industry, metallurgy, agriculture, medicine; household appliances, electrical motors, instruments, etc. Expositions of the CIS and Baltic Republics were the largest. Among foreign participants, Among foreign exhibitors the German companies: SIEMENS, OSRAM, ROBERT BOSCH, ELPRO AG, AEG, NARVA, BUSH-JAEGER, TELEFUNKEN Electronic were the most numerous. Austrian, Swiss, Polish and other companies also participated in the exhibit along with the US companies HIPOTRONICS and ARGUS TRADING. Illumination devices were not heavily represented, nevertheless, the exhibition fully reflected the technological level and the development trends in the field of light sources, illumination devices, control systems, etc. The most significant exhibition items of foreign companies are described in this review. Because of familiar economic reasons which retard scientific studies and development of new technology, materials and design, the exhibits from Russia, CIS and Baltic countries, in most cases, consisted of standard, well established, mass-produced articles, which were previously described in this journal. The bulk of these exponents were lighting fixtures for residences and public buildings. Figures 8, references 2 Russian.

#### **The Illumination Engineering Institute of the Berlin Technical University**

937K0104B Moscow SVETOTEKHNIKA in Russian  
No 10, Oct 92 pp 9-11

[Article by K. Stolzenberg; UDC 628.378]

[Abstract] A review is made of the development of illumination engineering studies in the Berlin University from 1889 to the present and of its present day activity. Since a thorough study of illumination technology is now possible only in conjunction with studies of electrical engineering and engineering equipment of buildings, a new course was introduced which covers decoration and installation works; it includes heating technology, air conditioning, acoustics, sanitation and fundamentals of building construction. In addition to teaching, the Technical University also conducts research. Solar radiation is a new topic. Research was intensified in the field of measurements and evaluation of infrared radiation. The illumination engineering institute is well equipped with measuring instruments and engineering facilities. In addition to several sphere photometers with a diameter of up to 3 m, a helical photometer is available for measurements of light flux. Illumination of light sources can be measured with a LMT Gonio D-2000 type photometer. An "artificial sky" apparatus was fabricated in 1990, capable of modeling brightness distribution of a clouded sky. The technical institute is financially supported by an association for assisting the Illumination Institute with participation of companies, unions and private citizens. For the enhancement of professional qualification of specialists the Institute offers 1-2 annual seminars dealing with different aspects of the illumination engineering. Figures 2.

#### **From Calculation to Documentation**

937K0104C Moscow SVETOTEKHNIKA in Russian  
No 10, Oct 92 pp 23-24

[Article by K. Ye. Glebin, M. V. Kligman; UDC 621.3:025.4.036]

[Abstract] The present day activity of the Electrical Engineering Department of the Moscow City Design, Planning, and Research Institute for Transportation is described. In addition to designing exterior and interior lighting, work is done in other electrical engineering specialties, including designing electrical traction equipment, devices for control, measurements, and automation, which determined a simultaneous development of automated design in several directions. The initial steps toward automation were made after acquiring a high capacity computer and organizing a computation center. Many design programs were developed for designing projected illumination, a program for designing construction and parameters of contact network of electrified railroads, electrical and mechanical designs of 6-220 kV power lines, etc. Now, the Department is developing software for designing directed lighting: projected illumination of industrial territory - "APPO-92", illumination by lighting fixtures - "NARSVETM". In addition, software is being developed for designing exterior networks up to 1 and 6-10 kV; mechanical design of 1-10 kV network - "MVL"; electrical designs of networks up to 1 kV - "LIN-1"; and electrical design and relay protection of 6-10 kV lines - "LINRZGRF".

### Russian Share of Space for Via Satellite Broadcasting

937K0091A Moscow RADIO in Russian No 10, Oct 92  
pp 2-4

[Article by V. Grishmanovskiy, doctor of technical sciences, and V. Godnya, candidate of technical sciences, Moscow]

[Abstract] The share of broadcasting services provided to the Russian Federation by the internationally owned "Intelsat", "Inmarsat", and "Intersputnik" satellites networks has been recently almost doubled by replacement of the "Gorizont"[Horizon] relay-satellites in geostationary orbits with "Ekspress"[Express] relay-satellites. As a result more central and Russian television programs can be broadcast over a territory completely covering Russia, Ukraine, Byelorussia, and all other republics of the former Soviet Union. The new "Ekspress" relay-satellites are superior to the older "Gorizont" ones, each consisting of 12 trunks with antennas designed for better performance and longer life. Their position in orbit can be stabilized to within 0.2° longitude and latitude. Their number will reach 10 by the year 1996, none of them requiring replacement of the existing communication channels but rather enhancing their throughput capacity upon changeover to the 12-18 GHz frequency band and appropriate equipment modifications. Figures 3.

### Radiation Dosimeters Conceived by Radio Amateurs

937K0091B Moscow RADIO in Russian No 10, Oct 92  
pp 13-16

[Article by Yu. Vinogradov, Moscow]

[Abstract] Several designs of radiation dosimeters have been submitted by radio amateurs which combine high sensitivity with instantaneous response to changes in the ambient radiation field. Their readings are so highly reliable that they can, but only under normal conditions, monitor uncontrollable background radiation and indicate potentially hazardous contamination levels much more reliably than do "organoleptic" effects. Such a device consists essentially of a Geiger counter with a microwatt power supply, an count pulse amplifier, a resistor which limits the discharge current during excitation of the counter, a capacitor which isolates the low-voltage amplifier stage from the high-voltage counter anode, and a telephone or other acoustic transmitter. One version of such a device is the miniature radiation indicator designed by V. Solonin (Konotop, Sumy Oblast, Ukraine): an SBM-20 Geiger counter (maximum count rate 4000 pulses/s) with a count pulse amplifier and a power supply consisting of a single voltaic cell. High voltage for the counter and low voltage for the amplifier are provided by a B14 shell-type push-pull transformer with a 1500NM or 2000NM ferrite core and six windings of PEV-2

("vinylex"-coated) copper wire: four coils having each 2 turns of gage 0.1 mm wire, one coil has 1000 turns of gage 0.05 mm wire, one coil having 60 turns of gage 0.05 mm wire. A second version of such a radiation dosimeter is the one designed by S. Sannikov and A. Babin (Yekaterinburg, Ukraine). It includes a pulse shaper in the form of a univibrator which consists of two microcircuit stages and converts the signal generated in the counter during each elementary excitation event into a stable current pulse, an integrating capacitor charged to a voltage proportional to the pulse repetition rate, and a 50-100  $\mu$ A microammeter with a scale roughly calibrated either in  $\mu$ R/h or in  $\mu$ Si/h. The duration of the current pulses, approximately 40 ms, is determined by the R5C7 time constant (R5 - resistor across univibrator input stage, C7 - capacitor inserted between univibrator input and output stages). The amplitude of the current pulses is determined by the operating point of the unijunction transistor in the power supply. The push-pull transformer in this device has three windings: one coil having 2 turns of PEV-1 ("vinylex"-coated) gage 0.2 mm copper wire, one coil having 530 turns of PEV-2 ("vinylex"-coated) gage 0.09 mm copper wire, and one coil having 8 turns of PELShO (enameled lacquer-proof and covered with single layer of silk) gage 0.12 mm copper wire. The diode in series with the high-voltage transformer secondary winding must withstand an at least 450 V peak inverse voltage, two KD102A diodes in series being acceptable. A third version of such a radiation dosimeter includes a digital counter with an indicator of its logic state, a timer which controls its operation, and a pulse shaper. The timer not only presets the counter into "0" initial position and then turns it off for recording but also controls, if necessary, turn-on of the logic indicator. Most suitable for determining the radiation dose in food products is the "thick layer" method, a specimen being cut so thick that a further increase of its thickness would not change the dosimeter reading. The total dosimeter reading consists of two other components, approximately additive, besides the monitored contamination level due to radioactive nuclides when present in the food product: 1) response to intrinsic background radiation, which may vary in time and therefore must be quite accurately measured; 2) response to potassium-40 when present in the food product. Radiation dosimeters are usually calibrated against a potassium compound such as KCl, considering that the radioactivity of pure potassium is 29.6 Bq/g. It is assumed that the intrinsic fluctuation noise in a Geiger counter depends solely and entirely on the irradiation, while the count rate depends linearly on the irradiation dose. In practical use of these dosimeters it must be considered that the spectrum of background radiation may appreciably differ from the not a priori known radiation spectrum of monitored radioactive nuclides in a food product and that, inasmuch as a Geiger counter is an avalanche device, the count rate depends also on the energy of incident particles or

radiation quanta. Another factor to be considered is the most often appreciable shielding effect of the dosimeter housing, which calls for a housing with windows covered with thin films or foils of a plastic material. Figures 9; tables 1.

#### Use of Series K555 Microcircuits

937K0091C *Moscow RADIO in Russian No 10, Oct 92*  
pp 30-31

[Article by S. Alekseyev, Moscow]

[Abstract] The basic features and functions of nine series K555 microcircuits (K555AP7/8/9/12/13, K555IR30, K555KP20, K555LP14, K555TM10) are described. The K555AP8 contains eight bidirectional bus pulse shapers for data transmission, analogous to the K555AP6 with a higher load capacity in the "0" state at the E input. Both the K555AP7 and the K555AP9 are analogous to the K555AP8, but the K555AP7 has open-collector outputs and the K555AP9 inverts input signals. The K555AP12 includes eight unidirectional buffer elements with inversion of input signals and possibility of switching outputs into the high-impedance state. The K555AP13 is analogous to the K555AP12, but does not invert input signals. These two microcircuits are designed to operate into a common bus and to raise the load capacity of microprocessor microcircuits. The K555IR30 is an 8-bit storage register with a single input and a decoder. The K555KP20 contains four multiplexers with two inputs each and with a storage register at the output. The K555LP14 includes four signal repeaters with possibility of switching outputs into the high-impedance state. The K555TM10 consists of two 2-bit storage registers with direct and inverse outputs. Figures 1; references 2.

#### Common Delay Unit for PAL and SECAM Decoders

937K0091D *Moscow RADIO in Russian No 10, Oct 92*  
pp 36-37

[Article by D. Voytsekhovskiy, Moscow]

[Abstract] A modification of the SMTs-2 SECAM decoder is proposed which will make it suitable also as a PAL decoder and ensure equal luminance of adjacent lines on the screen of 3USTsT color TV sets in both, undesirable inequality of luminance being particularly noticeable on screens larger than 32 cm measured diagonally. The ultrasonic delay line and the matching circuits are connected to the output of the chrominance signal amplifier through a special SECAM-PAL selector switch. Certain decoder components are first removed from the SECAM SMTs-2 decoder printed-circuit board and then used in assembly of the PAL decoder: VT1 transistor (KT3192Ye), VD1 diode (KD522B) and R4 resistor (4.7 k) in the emitter follower circuit, and R1R3-R2R3 resistors (R1 - 4.7 k, R2 - 6.2 k, R3 - 47 k) in the collector-base circuit. The now unwanted interconnection is eliminated by cutting open the appropriate

printed conductor and an additional jumper is inserted in the appropriate place. Figures 2; references 2.

#### Television Programs Broadcast Through Space

937K0089A *Moscow RADIO in Russian No 8, Aug 92*  
pp 2-4

[Article by B. Lokshin, candidate of technical sciences, Moscow]

[Abstract] Following a brief review of the principles of television broadcasting via satellite, a list is given of programs transmitted via seven satellites: Eutelsat II F1 (13° long.E), Eutelsat II F2 (10° long.E), ASTRA-1A + ASTRA-1B (19.2° long.E), Intelsat VI (27.5° long.W and 60° long.E), Intelsat VA (1° long.W and 63° long.E), ECS4 (7° long.E). Each program is identified by name, country, language, content, and carrier frequency. Programs from the satellites in positions 60° long.E, 63° long.E, and 1° long.W can be picked up in Byelarus, Ukraine, and Russia. Most interesting to viewers in the Russian Federation should be the eastern beam of Intelsat VI in the 27.5° long.W position, from which programs can be picked up through relays. Essential information given includes width and height of the receiver antenna necessary for reliable reception of programs in the eight territorial zones covered by the various satellites. Figures 1; tables 1.

#### Addresses of Russian-Language Radio Broadcasting Stations

937K0089B *Moscow RADIO in Russian No 8, Aug 92*  
pp 6-7

[Article by editorial staff]

[Abstract] The addresses of 28 foreign radio stations broadcasting Russian-language programs are listed: 1. RADIO TIRANA (Albania), 2. RADIO AFGHANISTAN, 3. RADIO VATICAN, 4. B.B.C. RUSSIAN SERVICE, 5. VOICE OF VIETNAM, 6. DEUTSCHE WELLE, 7. RADIO FREE EUROPE - RADIO LIBERTY, 8. VOICE OF GREECE, 9. ALL-INDIA RADIO, 10. KOL ISRAEL - OVERSEAS SERVICES, 11. ISLAMIC REPUBLIC OF IRAN BROADCASTING, 12. RADIO EXTERIOR ESPANA, 13. RADIO TELEVISIONE ITALIANA, 14. RADIO CANADA INTERNATIONAL, 15. RADIO BEIJING (China), 16. RADIO PYONG-YANG (Korea), 17. RADIO HANGUK (Korea), 18. ARAB JAMAHIRIYA (Libya), 19. RADIO ULAN BATOR (Mongolia), 20. RADIO POLONIA, 21. ROMANIA INTER-RADIO, 22. SYRIAN RADIO, 23. VOICE OF AMERICA, 24.

VOICE OF TURKEY, 25. RADIO FRANCE INTERNATIONAL, 26. RADIO SWEDEN, 27. FEDERAL RADIO YUGOSLAVIA, 28. RADIO JAPAN.

### Calculating Coordinates of Communication Facilities

937K0089C Moscow RADIO in Russian No 8, Aug 92  
p 9

[Article by A.Sychev, Tomsk]

[Abstract] Three programs are proposed for calculating on an Elektronika MK52 (or Elektronika 56, Elektronika 61, Elektronika B3-34) microcomputer three sets of coordinates of a correspondent when the location of the given receiving-transmitting radio station is given. The three sets of coordinates are: 1) latitude and longitude, 2) azimuth and distance, 3) azimuth and elevation angle. The calculations are based on relations of spherical geometry and aided by a world map. A correspondent's sets of coordinates have been calculated for a control example each within a time of 27 s, 27 s, and 23 s respectively. References 3.

### PAL Encoder

937K0089D Moscow RADIO in Russian No 8, Aug 92  
pp 37-39

[Article by O. Yablonskiy, Polotsk]

[Abstract] An encoder is proposed for use in generators of TV test signals which will ensure quick and good adjustment of PAL-system color TV receivers and video tape recorders for picture replay. This encoder can be built into the "Videotest-2M" (or "Elektronika GIS-02T", "Laspi TT-01") generator of test signals, to facilitate formation of either video-frequency or radio-frequency signals. It consists of six microcircuit modules: a quartz oscillator (DD1) followed by a frequency divider by 2 (DD2) with  $\frac{3}{4}$  clock period delay, a univibrator pair (DD3) with an RC delay circuit, a light-to-signal converter (DD4) of inverse R,B,G signals followed by a connector (DD5) to a programmable read-only memory (DD6) which also receives input from the univibrator pair (DD3). The programmable ROM is followed by a digital-to-analog converter which processes data stored and then retrieved from that memory. Use of such a memory makes it possible to obtain 2270 readings from two TV lines. The digital-to-analog converter, consisting of a 5.1 k $\Omega$  resistor in series with four resistors (8.2 k $\Omega$ , 3.9  $\Omega$ , 2  $\Omega$ , 1  $\Omega$ ) across the ROM output can generate 16 combinations with four quantization levels each. In order to connect the encoder to an "Elektronika GIS-02T" test generator, it is necessary to match the CMOS circuit structure with the TTL circuit structure. Figures 7; tables 2.

### Synchronous AM Detector With Single Microcircuit

937K0089E Moscow RADIO in Russian No 8, Aug 92  
p 43

[Article by M. Yevsikov, Moscow]

[Abstract] A synchronous detector with a 0.1 mV threshold sensitivity has been designed for superheterodyne AM radio receivers operating at the standard 465 kHz intermediate frequency. It includes only one microcircuit (series K174UR3), which combines an amplifier-limiter and a phase detector followed by an audio amplifier. The microcircuit is grounded. It requires a +(6-9) V power supply and draws a current of 10-14 mA. The input stage consists of five ceramic capacitors and one variable or adjustable resistor: input impedance 400  $\Omega$ . The output stage consists of one ceramic bypass capacitor and one oxide smoothing capacitor: output impedance 850  $\Omega$ . The detector operates without heterodyning and phase-lock automatic frequency control, which eliminates whistle and thus ensures interference-free operation of the i-f amplifier. The amplifier-limiter, designed to extract the signal from the carrier, suppresses only its amplitude modulation and not its phase modulation caused by interference. Ensuring complete interference immunity of detection would require placing either a narrow-band filter or a phase-lock frequency control loop in front of that amplifier-limiter. Figures 1; references 5.

### The Effect of Electrical Power Lines on TV Reception

937K0090A Moscow RADIO in Russian No 9, Sep 92  
pp 5-6

[Article by K. Zakharov, B. Melnikov]

[Abstract] Problems of electromagnetic interferences with radio and particularly with TV reception caused by a large number of long electrical power lines is discussed. Two principal reasons for generation of interferences from electrical power lines (EPL) in the TV frequency range are examined: formation of corona in the wire and local sparking. Studies of the EPL with voltages up to 750 kV indicated that interferences due to corona are recorded mainly in the frequency range up to 8 MHz, but can be manifested at higher frequency. Curves were drawn showing frequency dependance of the average value of relative attenuation of radio interference intensity at 15 meters from the EPL, and characteristic relationships of the field intensity as a function of frequency, measured at a normalized distance from three EPL. The level of spark interferences from the ELP does not depend on the intensity of the line, but is determined by the technical conditions of the line and weather. The field intensity of interferences is reduced with increased frequency. Elimination of interferences with TV reception from the ELP by filters is impossible. Some attenuation can be achieved using directional antenna, while

the antenna must be directed toward minimum interference and not to the maximum signal. Figures 3.

### The Ultrashort Wave Antenna

937K0090B Moscow RADIO in Russian No 9, Sep 92  
pp 7-8

[Article by A. Gerasimov]

[Abstract] An ultrashort wave antenna that can provide a high quality stereophonic reception was developed and its construction is described. The gain of this antenna is 11.5 dB; the width of the antenna pattern in the horizontal plane is 42°, and in the vertical plane is 60°. An oscillator made of three tubes with an input impedance of 657 Ohm and a matching device with a 1:1 transformation ratio is used to increase the efficiency. The electric diagram of the matching device and the wiring circuit in the antenna box are provided. The antenna can be used in a two-antenna array. Procedures for increasing the antenna gain and for tuning the antenna are described. This antenna array with an amplifier is used for reception of stereo programs from a transmitter located at a distance of 160 km. Figures 6.

### A Light Signalling Device of Telephone Calls

937K0090C Moscow RADIO in Russian No 9, Sep 92  
pp 23-24

[Article by G. Gvozdit'skiy]

[Abstract] A light flushing device which signals telephone calls was developed. The block diagram of the electrical circuit is provided and the wiring procedures and the component parts are described. The device is power supplied from a 220 V line by a rectifying bridge. From its output a pulsing voltage is applied to signalling lamp circuit, and to a stabilizer providing a supply of 10-12 V. When a call is received the lamp of the telephone will light up simultaneously with the call signals.

### A Remote Controlled System Employing Infrared Beams for ZU STsT Television Receivers

937K0090D Moscow RADIO in Russian No 9, Sep 92  
pp 35-36

[Article by V. Kivrin]

[Abstract] A system for remote controlled switching of TV channels is described. The system employs infrared beams and can function at a range of up to 5 meters. It is capable of switching TV channels in a forward as well as in a reverse order in TV receivers which have a sensor control device USU-1-15. The system contains two functionally complete units: a control unit and a servo-unit which is installed in the TV. Block diagrams of both units are provided and their operation is described. The system can be readily constructed by following the

instructions. The adjustment of the device consists of tuning a filter to the 12 kHz carrier frequency of the control signal. Figures 3.

### An Individual System for Receiving Satellite TV

937K0090E Moscow RADIO in Russian No 9, Sep 92  
pp 37-39

[Article by V. Botvinov, Ye. Karnaukhov]

[Abstract] A tuner for individual reception of satellite signals is described. The tuner consists of a device for selecting the program, and processing the video and audio signals. A functional block diagram and block diagrams of the electronic circuits are provided. It is designed as a wideband FM receiver with a single conversion of the sub-carrier frequency. Composition of the component parts, their functioning and procedures for assembly and frequency adjustment are described. (to be continued in the next issue of the journal). Figures 5.

### Visibility Calculation of Indicating Instruments

937K0088A Moscow SVETOTEKHNIKA in Russian  
No 6, Jun 92 pp 1-3

[Article by A. A. Vaskovskiy, T. S. Ziyenko, V. A. Latyshev, S. S. Romanov, Moscow Energy Institute, All Union Light Engineering Institute; UDC 621.383.932:621.843.36]

[Abstract] An Algorithm for determining the indicating instrument's visibility was developed. A threshold contrast at the 0.5 recognition probability level is normally selected for the computation of visibility. In application to the indicating instruments this value of probability is not in accord with functional purpose of the instruments and therefore a level is selected, which corresponds to 0.98 probability. The visibility is measured here by a ratio of real contrast of the indicating instrument to its threshold value. In the developed method the characteristics of visual perception are described by equivalent noise power (ENP). If the ENP parameters for the examined conditions are known, the normalized values of signal-to-noise ratio of the images are computed, if they are unknown, some small additional experimental investigations must be performed. As an example of the method application, the visibility of sign-synthesizing indicating instrument (SSII) is determined by computing the SSII threshold contrast as a function of the maximum-to-minimum brightness ratio of the instrument reflecting elements. Curves are provided showing changes of the threshold value as a function of the degree of brightness distribution of the image elements. Application of normalized values of signal-to-noise ratio allows to obtain explicit relationships for probability of the image recognition. Figures 5, references 7 Russian.



### Multilayer Interference Coating in Discharge Lamps

937K0088B Moscow SVETOTEKHNIKA in Russian  
No 6, Jun 92 pp 3-5

[Article by V. B. Gritskevich, A. S. Ivantsev, All-Union Institute of Light Sources; UDC 628.9.621.327:535.2]

[Abstract] Semiconductor and dielectric optical films are used with the contemporary discharge lamps for correcting the radiation spectrum and increasing the illumination intensity. The parameters of these films are difficult to compute and the coating technology of some of them is ecologically harmful. In this article the multilayered interference coating (MIC) is examined for application with discharge lamps in order to increase their illumination and to correct the radiation spectrum in any spectral range. The MIC computations involve analysis and synthesis. The analysis consists of finding spectral characteristics of the MIC reflection or transmission, while the synthesis consists of determining the MIC layers parameters from spectral characteristics of reflection or transmission, specifically, determining the number of layers, the index of reflection, and the thickness of each layer. Containing no ozone, xenon high-pressure lamps and sodium lamps were synthesized. MIC were deposited on a bulb by an ecologically pure chemical method of gradually drawing organic compounds from the solution. For obtaining films with a specified thickness, its relationship to the concentration of the film forming solutions and to the rate of drawing was experimentally determined. The results of this study are described and the nomographic charts showing the  $\text{TiO}_2$  and  $\text{SiO}_2$  films thickness as a function of the solution concentration and the rate of drawing are provided. Figures 4, references 10 Russian.

### Photometric Properties of Dust Sediments on Translucent Barriers

937K0088C Moscow SVETOTEKHNIKA in Russian  
No 6, Jun 92 pp 9-13

[Article by G. I. Khavaldzhi; Central Scientific Research Institute of Electric Instruments "Selstroy"; UDC 628.935:621.84]

[Abstract] Dust (aerosol) is the major source and reason for negative effect on translucent barriers. The physical and photometric properties of dust are very diverse. Quantity and type of dust sediments affect the light transmission and structural properties of translucent barriers; spectrum and character of the light beam scattering is changed by the dust. The quantitative effect of dust on light transmission, quantitative features of different dust sediments and their classification by photometric indications, estimates of spectral changes in the light beam, and the actual transmission characteristic are discussed here. Practical solutions of the photometric aspects of the problem are examined. Spectrophotometric studies were conducted for ordinary street dust

in the frequency range between 306 to 1200 nm. Nomographic charts were prepared showing the photometric properties of dust sediments. Figures 9, references 8 Russian.

### Selecting the Operating Mode of an Irradiator for Photohardening of Lightguide Coatings

937K0088D Moscow SVETOTEKHNIKA in Russian  
No 6, Jun 92 pp 13-15

[Article by S. G. Ashurkov, A. A. Makovetskiy, Yu. R. Tsurin, All-Union Light Engineering Institute, Institute of Radioengineering and Electronics, All-Union Institute of Cable Industry; UDC 621.327.5.534:535-31:681.7.068]

[Abstract] Ways for increasing the efficiency of ultraviolet radiation sources (UVRS) with mercury high-pressure tubular lamps which are being employed for manufacturing fiberoptic lightguides are discussed. In order to obtain data on single or combined effects of a lamp's burning in a pulsed mode, experiments were conducted with a model UVRS. The irradiated samples consisted of photo-composite layers of the De Solite 950-132 type, (De Soto, USA), which is one of most typical urethane-acrylate photo-composite material used for obtaining a single-layer lightguide's coating. The coating procedures are described and the electric parameters of the pulsed mode of operation are listed in a table. Kinetic curves of photo-hardening of one of the sample are also shown. The experiments demonstrated that the efficiency of UVRS with high-pressure mercury lamps for photo-hardening of fiber optic lightguides coating can be realistically increased by a factor of 1.4, when operating in a pulsed mode with a reflector and a quartz tube in an inert radiation medium. Figures 2, tables 2, references 9: 6 Russian, 3 Western.

### Corrections and Supplements to the Engineering Method for Computing the Ripple Factor of Illumination

937K0088E Moscow SVETOTEKHNIKA in Russian  
No 6, Jun 92 p 24

[Article by Ye. I. Myasoyedova, V. N. Utkin, All-Union Light Engineering Institute; UDC 621.94.001]

[Abstract] Corrections and additions to the earlier developed engineering method for determining the illumination ripple factor  $K_r$  of lighting devices are discussed. In order to reduce the ripple factor, the adjoining fixture of each lighting device must be connected to different phases of the three-phase network. Illumination at any point is a sum of illumination produced by the lighting devices connected to the phases A, B and C. When compiling the tables for  $K_r$ , the maximum illumination  $E_A$  from the lighting device connected to phase A is conditionally accepted as 100 percent. Since the character of changes in time of different type luminescent lamps is practically identical, a common nomographic



chart can be constructed to determine the  $K_r$  with a conditional ripple index equal to 100 percent. Procedures for computing  $K_r$  at a selected point are described. Tables are provided listing values of  $K_r$  for different lighting devices. Tables 4, references 3 Russian.

### Single-Tube High-Resolution Color TV Cameras Using Multisignal Vidicons

937K0086A Moscow *TEKHNICA KINO I*  
*TELEVIDENIYA* in Russian No 10, Oct 92 pp 46-51

[Article by A.Ye. Gershbert, All-Russian Scientific Research Institute "Elektron"]

[Abstract] Problems in designing high-resolution color TV cameras with multisignal vidicons are analyzed, a major advantage of vidicons over charge-coupled image sensors being their simpler construction and the uniformity of their target surface. Vidicons with frequency-phase coding and vidicons with frequency multiplexing are considered. The two main drawbacks of frequency-phase coding are noise in the chrominance channel and nonuniformity of signals. Frequency separation of the luminance channel and the chrominance channel, with the latter occupying a higher frequency range, contributes to raising the noise level and weakening a signal as it is extracted from the narrow strips of the coding filters. Unequal attenuation of extracted chrominance signals at the center and at the periphery of the raster limits its resolution. Because the R and B signals are extracted from filters while the G signal is independent, adjusting the color balance from one raster segment to the others will upset it and thus result in color distortions. Even a small difference between the magnitudes of a filtered signal at the center and at the periphery can be the cause of excessively large color distortions. Complete equalization of signals from fine details covering the raster field has not yet been achieved, even by dynamic focusing. Neither can dynamic focusing completely eliminate asymmetry and nonuniformity of those signals caused by imprecision of system components assembly and by electron-optical aberrations attending beam deflection. This They can be eliminated by tuning the camera with uniform light and use of a special memory which stores signals from all raster segments. Cameras using vidicons with frequency multiplexing are superior, inasmuch as the frequency band of the chrominance signals may lie within that of the luminosity signal. This accomplishes the following: 1) eliminates restriction on the frequency band of the luminance signal, 2) eliminates the need for an optical filter of low space frequencies and thus avoids a decrease of the percentage modulation; 3) allows widening the strips of the optical filter in order to make the extracted signals stronger and less nonuniform, 4) allows pulling the chrominance channel into a lower frequency range in order to reduce the noise level in it. Nonuniformity of filtered signals across the image field is most effectively minimized by gain control of amplifiers. One of two factors preventing proper operation of low-distortion cameras with frequency coding is nonlinearity of the vertical sweep, which prevents the electron beam

from always sweeping lines separated by distances corresponding to a  $\pi/2$  filter phase shift. This nonlinearity has not been completely eliminated but its effects have been minimized in the Interplex high-resolution color TV system (M. Koubek, Siemens GmbH) with a Sicolor K 60 single-tube camera. The second factor preventing proper operation of low-distortion cameras is signal nonuniformity across the image field. This difficulty has not been overcome in the Interplex system, because it does not include gain control but instead supplements rather ineffective dynamic focusing with magnetic focusing so that, moreover, signal resolution becomes very nonuniform across the image field. Raising the level of the chrominance signals and minimizing their nonuniformity in a camera with frequency multiplexing thus requires lowering their frequency, while maximizing the resolution of the luminance signal requires widening its frequency band. That frequency band may then contain not only the fundamental component of a chrominance signal but also its harmonics. Such a camera will thus have to include a device for separating the luminance signal from the chrominance signals. Two devices under consideration are frequency-phase coding and index coding of color information. With frequency-phase coding it is possible to attain a resolution within the range of high-definition TV requirements, if the second harmonic of chrominance signals is excluded from the frequency band of the luminance signal. Increasing the number of lines and adoption of the line-by-line scanning technique will then also raise the signal resolution within a frame. Index coding makes possible frequency interlacing, in tricon filters. This will improve the camera performance in terms of better color transmission and higher response speed, but the presence of a large second harmonic in the triad array of tricon filters will lower the attainable signal resolution. Figures 2; references 6.

### Dependence of Signal Quality in TV Charge-Storage Image Sensors on Scanning Mode of Scan

937K0086B Moscow *TEKHNICA KINO I*  
*TELEVIDENIYA* in Russian No 10, Oct 92 pp 51-57

[Article by V.N. Bezrukov, G.K. Rosatkevich, and V.F. Samoylov, Moscow Communication and Information Engineering University]

[Abstract] Use of light-to-signal converters with charge storage in TV systems for remote control of industrial objects is considered and various methods of scanning such converters are examined, for their comparative evaluation from the standpoint of signal quality. Such a converter must feature: 1) maximum possible signal-to-noise ratio, which will determine the minimum necessary illumination and contrast; 2) minimum signal nonuniformity at black and white levels, which will maximize both camera sensitivity and object detectability; 3) minimum synchronous interference in the sweep circuits and in the sync generator. The scanner in any TV system with such a converter must feature: 1) constant

storage time across the entire image field; 2) constant scanning speed and thus constant signal amplitude; 3) minimum length of the scanning beam trajectory over a period of vertical sweep, thus a minimum passband ensuring maximum space period of the image and maximum angular resolution; 4) high directivity of both orthogonal sweeps and their constant orientation, which will optimize extraction of a mismatch in the automatic stabilization and tracking systems; 5) periodic 90° shift of scanning direction, which will simplify extraction of a vertical mismatch; 6) adaptive control of the scanner aperture size or of the scanning step, aimed at minimizing redundancy in the signal from an object and thus facilitating adaptation of the static characteristics of that signal to those of the signal processing logic device; 7) compatibility of analyzed and synthesized apertures, making it possible to display the signal without use of a TV-standard converter and to view the image with either manual or automatic control; 8) retention of the center of the readout raster at a fixed location on the tube target during change from visual tracking to automatic control; 9) means of changing the image scale on the raster for improvement of the observation. Most hardware is needed for two-dimensional enlargement of the image, which can be done in at least three ways: 1) in the optical channel of the transmitter camera, by defocusing the optical image with the aid of an objective lens or a matted or opaline glass plate; 2) on the converter target, by changing either the size of the scanner aperture (with the aid of electromagnetic multiband lenses or by changing both size and shape of the diaphragm) or the mode of target scanning and subsequent signal averaging; 3) in the signal processing channel with the aid of delay devices for formation of a multielement aperture and subsequent averaging over fragments. Several known scanning modes are considered and for use in industrial TV remote-control systems and are comparatively evaluated with respect to signal nonuniformity as key criterion: 1) interlaced or progressive linear scan, 2) triangular scan, 3) linear scan with frame-to-frame reversal of vertical sweep direction (triangular scan without vertical retrace), 4) "orthogonal" scan (linear scan with directions of both horizontal and vertical sweeps changed by 90°), "quasi-random" aperture moving along the trajectory of a perfectly rigid sphere on the closed surface of the scanned target), 6) "filtering" Gilbert-Peano scan (two-dimensional filtration of the image by an array of microrasters). Sinusoidal and spiral scans are not considered here, because their speed varies in the process. With a spiral scan, moreover, a signal cannot be formed at the center of the raster. Only linear and "filtering" scans satisfy requirements 1), 2) of constant charge storage time and constant readout speed. Linear scan also satisfies requirements 4), 7), 8), 9) and "filtering" scan also satisfies requirements 3), 4), 6), 9) regarding the aperture. None of the scans can satisfy requirement 5) without violating requirements 1) and 7). Figures 4; tables 1; references 19.

### Adaptive Structure of Synchronization System for PhCCD Cameras

937K0086C Moscow *TEKHNIKA KINO I TELEVIDENIYA* in Russian No 10, Oct 92 pp 57-59

[Article by V.A. Golovlev, N.Ye. Uvarov, V.V. Fedorenko, and N.G. Khitrovo, Scientific-Industrial Association "Impuls"]

[Abstract] Problems in producing large-scale-integrated (LSI) synchronization structures for cameras with PhCCD charge-coupled image sensors are examined, these image sensors steadily improved and development of one sync generator adaptable to all of them being proposed as a much more practical and also more economical solution than development of a new sync generator for each new PhCCD camera model. Inasmuch as the frequency of the primary clock generator in the synchronization structure must match the number of horizontal resolution elements in the charge-coupled image sensor, it becomes necessary to raise the clock frequency as image sensors with higher line resolution become available: typically from 21 MHz for a K1200TsM7 LSI PhCCD (360 x 580 format) to 25.4 MHz for a K1200TsM15 LSI PhCCD (440 x 580 format) and to above 27 MHz for new ones (760 x 580 format). When image sensor and sync generator are mounted on one chip (CMOS technology), then raising the clock frequency will make it more difficult to ensure synchronous generation of phase voltages by the register and will make interference from the sync generator through the common substrate stronger at the register switching threshold so that pulse-width modulation of the register phase sequences may reach or even exceed 1 percent. When the synchronous register is mounted on a separate chip, then the phase of the register stopping pulse will drift relative to the starting clock sequence, sufficiently to distort the extraction of information-carrying charges from the output register and turn this process into random variations of the mean luminance of lines. These problems can be avoided by use of an adaptive synchronization structure with a 3-phase start-stop register mounted separately from the LSI sync generator. Such a register generates phase voltages without clocking, the start phase being read from where the stop pulse actually falls. Such a register can be included in other LSI structures (drivers, level converters) which do not generate excessive interference in it. Use of a 3-phase self-excited oscillator as register allows the LSI structures to operate at lower speeds and thus makes it feasible to use economical CMOS LSI components. Adaptation is achieved very simply by means of an adaptive frequency divider and by making the conversion factor equal to half the number of image sensor elements. Such a synchronization structure has been built with thick-film components printed on a bilaterally clad ceramic board-substrate also carrying bare LSI chips on a polyimide carrier (produced by Scientific Research Institute "Pulsar"). It was tested and found to be adequate for use in TV cameras with

already available PhCCD image sensors as well as with those now being developed. Figures 2; tables 1; references 3.

### Reliability of Some TV Equipment Under Operating Conditions

937K0086D Moscow *TEKNIKA KINO I*  
*TELEVIDENIYA in Russian No 10, Oct 92 pp 60-62*

[Article by T.I. Yegorova and M.V. Kreynge, All-Russian Scientific Research Institute of Television and Radio Broadcasting]

[Abstract] Some key TV video production and engineering equipment was tested for reliability under operating conditions, the most important items being: 1) 103 "Kadr-103STs" color video tape recorders (Novosibirsk manufacturing plant), 2) 145 KT-190 cameras ("Volga" Novgorod manufacturing plant; 3) 28 "Magnoliya 83A", 20 "Magnoliya 83A-2", and 18 "Korpunkt-1" mobile TV transmitter stations consisting each of either a KT-178 camera ("Magnoliya 83A,83A2") or a KT-190

camera ("Korpunkt-1"), a "Kadr-103STs" video tape recorder, a sound track, and a video monitor with accessories; 4) 13 large and 8 small studio equipment modules consisting each of a KT-178 camera, and a video monitor with accessories. Tests were performed in 86 cities spread over the entire former Soviet Union. The total operating time over the 1988-1991 period ranged from 8,064 h ("Magnoliya 83A-2") to 27,867 h (large studio equipment modules) and the number of failures, as reported by 1 April 1992, ranged from 48 ("Kadr-103STs" video tape recorders in 1990) to 576 ("Korpunkt-1" in 1991). The weakest components were found to be the cameras (KT-190 in "Korpunkt-1", KT-178 in all studio equipment modules) and the "Kadr-103STs" video tape recorder. No modification of the manufacturing process introduced during that 1988-1991 period toward improving the reliability of these components has noticeably lowered their failure rate. Reliability studies and testing therefore continue, as requested by the "Ostankino" radio-television group and domestic manufacturing enterprises. Tables 2.

**The Mechanism of Super-Resolution of a System of Wave Field Sources With Digital Reconstruction of Coherent Radio-Images**

937K0132A Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian* Vol 38, No 1, Jan 93 pp 25-33

[Article by V. N. Garmash, K. E. Yefimenko; UDC 621.396.67.001.24:778.38]

[Abstract] A linear digital method for reconstructing radio images of a system of vector currents from the electric field of their radiation, measured with a phased antenna array is discussed in this article. The mechanism of producing "super-resolution" of discrete sources is examined taking into account the errors generated by field measurements. This method has certain advantages compared to the methods of nonlinear spectral analysis of high resolution, due to minimal requirements for the availability of a priori information, including statistical, about the reconstructed radio image. Continuous and discrete (in spatial coordinates) solutions are obtained, and statistically regularized. It is demonstrated that a significant increase in resolution, compared to the Rayleigh limit, is possible with a reduced volume of measurements. Figures 5, references 18: 9 Russian, 9 Western.

**Engineering Method for Designing Complex Waveguide-Slot Antenna Arrays**

937K0132B Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian* Vol 38, No 1, Jan 93 pp 81-92

[Article by S. V. Kiselev, V. A. Kritsyn; UDC 621.396.677]

[Abstract] Equations are obtained for analysis and synthesis of resonant waveguide slot antenna arrays (WSAA) with a complex excitation structure, using magnetomotive force (MMF) equations and the slot model in a form of lumped conductivity. This article deals with expansion of a previously developed method which uses a long line with lumped equivalent conductivities of the slots as a model for a waveguide slot section, taking into account their interaction with other slots. Relationships between the equivalent conductivity of the slot in the WSAA, and the characteristic equivalent conductivity of this slot were derived. If the conditions of the slots equivalence to the lumped conductivity or impedances are satisfied, application of the developed relationships for the WSAA analysis and synthesis has many advantages, compared to the direct solution of the system of MMF equations. This includes the feasibility of employing approximations of empirical relationships of the characteristic equivalent conductivities of the slots as a function of their size and position in the waveguide, and provides a better convergence of the equations, compared to the MMF system. Figures 2, references 10: 5 Russian, 5 Western.

**Shape Deformation of the UHF Pulses With Propagation Through Magnetostatic Wave Devices**

937K0132C Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian* Vol 38, No 1, Jan 93 pp 173-182

[Article by S. A. Vyzulin, G. V. Zaporozhets, N. I. Vyrodov, V. V. Zaporozhets; UDC 621.372.822]

[Abstract] Within the framework of the theory of optimal filtering an explanation is provided for the shape deformation of a klystron generated microwave pulse while it propagates through a magnetostatic wave (MSW) device. Analytical estimates of the dynamics of the pulse shape changes in pre-threshold region are made for different parameters of signal processing system of a MSW device. Qualitative estimates are made of the amplitude and phase-frequency characteristics of the output signals, and the results are verified experimentally. It is demonstrated that when developing controlled delay lines for pulsed signal processing systems, the effect of microwave signal spectrum transformation must be taken into account in order to obtain signals at the output with a required shape. Figures 3, references 7 Russian.

**Long-Wave Electromagnetic Radiation Penetration into Planar Waveguide With Flange**

937K0130A St. Petersburg *ZHURNAL TEKHNIЧЕСКОY FIZIKI in Russian* Vol 62 No 5, May 92 (manuscript received 26 Nov 90, after revision 1 Apr 91) pp 99-107

[Article by Ye. A. Galsmyan and O. V. Gornostayeva, Moscow Radio Engineering Institute]

[Abstract] Analytic expressions for TEM wave penetration and reflection factors were derived in longwave approximation based on a rigorous solution, using the Wiener-Hopf method, to the problem of excitation of a planar waveguide with a flange and the radiation from it. The dependency of the electric field in the aperture of a planar waveguide with a flange on the relationship between the incident radiation wavelength and aperture dimensions was investigated. The limiting value for amplifying the field in the aperture center was derived. The expressions can be used to derive an estimate of the maximum field amplification for any flange plane inclination relative to the waveguide axis. Figures 4; references 9: 6 Russian, 3 Western.

**Feasibility of Focusing and Transporting Relativistic Electron Particles in Dense Gases in a Field of a Powerful Electromagnetic Surface Wave**

937K0114A St. Petersburg *PISMA V ZHURNAL TEKHNIЧЕСКОY FIZIKI in Russian* Vol 18 No 13, Jul 92 pp 1-4

[Article by L. V. Norinskiy, I. V. Smetanin, RAS Physics Institute, Moscow]

[Abstract] An open plasma waveguide with an excited electromagnetic surface wave (EMSW) is proposed for focusing relativistic electron particles. The field configuration in the EMSW is naturally suited for construction of a potential "conduit" for the beam transport. With this system it is also possible to achieve an optimal degree of inhomogeneity and field ratio in the EMSW by varying the geometrical and electro-physical characteristics of the plasma channel and frequency of the excited wave. This method can be used in a wide pressure range of gas media, including atmospheric. A case of axially-symmetrical E-type EMSW, propagating along an open plasma waveguide in the form of a cylindrical channel is examined here. Radial plasma distribution within the cylinder is constant and has a sharply defined boundary. The system is uniform along the propagation axis, and the plasma is assumed to be cold and locally isotropic. A potential well is produced for the charged particle within the waveguide by the field, which is concentrated near the media interface. This situation can be used for focusing the relativistic beams of charged particles. Motion of the charged particles is examined and some estimates are made. References 5: 4 Russian, 1 Western.

#### Possibility of Coherent Radiation in a Non-Resonant Spin System

937K0114B St. Petersburg PISMA V ZHURNAL  
TEKHNICHESKOY FIZIKI in Russian Vol 18 No 13,  
Jul 92 pp 5-9

[Article by T. S. Belozeroval, V. K. Khennel, V. I. Yukalov,  
Consolidated Institute for Nuclear Research, Dubna]

[Abstract] It is demonstrated here that a spin system can have a coherent radiation also without a resonator, and for a time which is greater than the spin-spin relaxation time. This effect can be produced either by external pumping, or even without pumping, by an accurate accounting of inhomogeneities of the system of spins, interacting among each other due to dipole-dipole forces. A microscopic approach is used for describing these effects by solving microscopic (and not phenomenological) equations of the spin motion by computer modeling. Results of computations are described. Two situations are revealed when a coherent radiation occurs in a non-resonant system. This effect can be used for developing generators of coherent radiation in the radio frequency range. Figures 2, references 5: 2 Russian, 3 Western.

#### Generation of Second Harmonics in Optical Fibers Exposed to Gamma Radiation

937K0114C St. Petersburg PISMA V ZHURNAL  
TEKHNICHESKOY FIZIKI in Russian Vol 18 No 13,  
Jul 92 pp 39-42

[Article by I. V. Kityk, Lvov State University]

[Abstract] For artificial generation of defects, lightguide fibers were exposed to radiation by hard particles, specifically to gamma radiation. Infrared radiation (IR) of yttrium-aluminum laser on neodymium centers with modulated

Q-factor was applied to the fiber using a short-focusing lens. Simultaneously with the IR-radiation, a second harmonic signal was applied to the waveguide. The pulse repetition rate was 2.6 kHz, and the maximum power was 3.1 GW/cm<sup>2</sup>. When counting, the second harmonic power, which was not greater than 28 MW/cm<sup>2</sup> was suppressed by filters. Cobalt isotope was used as a source of gamma-radiation. The examined samples were placed in a helium cryostat, which made it possible to regulate the temperature. The experiments demonstrated, that the second harmonic output signal became greater with time, saturating 150-200 sec after the beginning of the IR-radiation. It was revealed that the most optimal IR-laser power lies within 2.6-2.8 GW/cm<sup>2</sup> range. Figures 2, references 6: 4 Russian, 2 Western.

#### Parametric Instability in Radiofrequency Ceramic VTCP SQUID

937K0114D St. Petersburg PISMA V ZHURNAL  
TEKHNICHESKOY FIZIKI in Russian Vol 18 No 13,  
Jul 92 pp 71-74

[Article by Ye. V. Ilichev, V. V. Kutyrev]

[Abstract] It is demonstrated that in nitrogen high temperature SQUID an instability can be produced due to selection of the operating point at some constant dimensionless parameters. To test this phenomenon sensors were fabricated from YBa<sub>2</sub>Cu<sub>3</sub>FeO<sub>7-x</sub> with T<sub>c</sub> = 90 K. Values were recorded of the alternating voltage in the resonant circuit as a function of the pumping current and of the direct current in the resonant circuit coils. These experiments were conducted in liquid nitrogen. High-frequency volt-ampere characteristic of a SQUID, which was recorded at the resonant frequency of the circuit - SQUID system and signal characteristics, which were obtained for different amplitudes of the pumping current are shown in graphs. The particular feature of the high-frequency VA characteristic is exhibited by a presence of the "noise" region in the initial section of the curve. Beyond this region (at "large" amplitudes of the pumping current) the SQUID behaves normally. For studying these features signal characteristics were recorded at different pumping currents and the results were analyzed. Figures 2, references 6: 5 Russian, 1 Western.

#### Selecting the Structure of the Phase Code Forming Unit of a Digital Signal Synthesizer With a Polynomial Frequency Modulation

937K0111A Kiev IZVESTIYA VYSSHIKH  
UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA  
In Russian Vol 35 No 5-6, May-Jun 92 pp 3-13

[Article by A. N. Zharov, V. N. Kochemasov; UDC  
621.391]



[Abstract] A phase code forming unit (PCFU) of a digital signal synthesizer with polynomial frequency modulation, consisting of sequentially connected digital integrators is examined in this article. Conditions are obtained for truncating the size and reducing the synchronization frequency of digital integrators when the error of the formed signal phase (frequency) is not greater than maximum admissible. This PCFU uses a "ladder" type connection of digital integrators. Examples are provided of designs of PCFU synthesizers with a polynomial and linear frequency modulation. A significant saving of hardware and consumed power can be made with these designs compared to the regular approach. Figures 4, references 8: 7 Russian, 1 Western.

#### **Analysis of a Recurrent Algorithm for Detection of Stochastic Signals**

937K0111B Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
In Russian Vol 35 No 5-6, May-Jun 92 pp 14-24

[Article by A. N. Yuryev; UDC 621.391.01]

[Abstract] This article deals with an analysis of one of the algorithms, previously synthesized by the author, for detection of stochastic signals specified in a space of states. Their recurrent character constitutes a particular feature of these algorithms: the algorithm's function in a space of states and are a direct analog of the Kalman filter for detection problems. A relationship is illustrated between the weight coefficients of the processing system, implicitly formed by the algorithm. Dynamics of the system's gain and feedback is investigated and its detection characteristics are computed. Previously obtained results for non-correlated noise are extended to the case of signal detection in the background of stochastic correlated interference and non-correlated noise. Figures 4, references 3: 1 Russian, 2 Western.

#### **Methods for Forming Sequential Multifrequency Pseudo-Random Signals and Their Comparative Efficiency**

937K0111C Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
In Russian Vol 35 No 5-6, May-Jun 92 pp 25-31

[Article by V.V. Pus; UDC 621.396.22.018.424]

[Abstract] Three methods for forming frequency-time (FT) matrices of sequential multifrequency signals are discussed: a pseudo-random (PR) method, based on filling the FT matrix with sections of PR sequence along rows and columns; a permutation method, consisting in filling the FT matrix along rows or columns with PR permutations; and an isotopic method, involving a PR permutation of rows, columns, and renaming the elements within the latin square. Efficiency of non-coherent signal reception, formed by the above listed methods under impact of a quasi-harmonic interference is estimated using statistical testing. Methods are examined

here for forming sequential multifrequency (SMF) signals, whose structure is specified by the FT matrix, and whose element's (frequency) change is made according to the pseudo-random sequence, which is identical at the transmitting and the receiving ends of the communication system. Figures 2, references 10: 4 Russian, 6 Western.

#### **Effect of Noise on the Accuracy of Estimating the Position of the Center of an Extended Object**

937K0111D Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
In Russian Vol 35 No 5-6, May-Jun 92 pp 39-44

[Article by A. A. Monakov; UDC 621.397.96]

[Abstract] It was previously demonstrated that without accounting for the effect of the intrinsic noise of a receiver, the estimates made of intensity weighted independent individual samples of the error signal coincide with the estimates of maximum likelihood of angular position of the energy center of an extended object. The intrinsic noise effect in a direction finder is similar to the effect of spatial isotropic white noise, which with a small signal-to-noise ratio will cause shifting of the error. In his work on "Maximum likelihood estimation of the angular position and extend of a target" I. V. Milstein considered only the case when the noise power is accurately known, was not able to correctly determine the probability characteristics of the obtained estimates, and arrived at an erroneous conclusion concerning absence of two first moments in the error distribution. In order to correct this conclusion, a statistical analysis is made here of different algorithms for estimating the position of the energy center of an extended object taking into account the effect of the intrinsic noise of the receiving device. Figures 2, references 4: 3 Russian, 1 Western.

#### **Analysis of Interaction Between a Delayed Electromagnetic Wave and Liquid Media**

937K0111E Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
In Russian Vol 35 No 5-6, May-Jun 92 pp 50-54

[Article by A. A. Yelizarov, Yu. N. Pchelnikov; UDC 621.385]

[Abstract] Interaction efficiency of an electromagnetic wave delayed by a liquid media (water, salt solutions, and suspensions) is analyzed. It is demonstrated that a uniform interaction of a delayed wave with liquid can not be provided along the entire volume, which limits practical application of thermal processing and control of the parameters of liquid media in the microwave range. By reducing the frequency down to several MHz, a uniform field distribution along the transverse cross section of the effective volume can be provided due to a deep penetration of the field into the dielectric. However, this significantly reduces the linear attenuation and increases the dimensions of the chamber. The above



shortcoming can be eliminated by employment of a delay system, specifically, a cylindrical coil. Figures 2, references 3 Russian.

#### **Estimates of the Ultimate Values of Bursts of a Distant Noise**

937K0111F Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
In Russian Vol 35, No 5-6, May-Jun 92 pp 74-76

[Article by G. G. Dzhavadov, V. F. Kozlov; UDC 621.396.967]

[Abstract] When determining the coordinates of an extended object, estimates are made of the point which represents the center of reflection. Because of the wave interference, its spatial position is continuously changing, which is manifested in radar as a "scintillation noise" (SN). Angular scintillations have been thoroughly studied before, and in studies dealing with the SN in range measurements it was demonstrated that the range scintillations are similar to the angular scintillations. Although being similar, they exhibit a different character with some measuring devices. The process of measuring the coordinates of a range to an extended object using pulsed radiation is examined here. It is assumed that the radar target consists of two rigidly connected local sources. Each of the local sources is a complex object, formed by a combination of several elementary reflectors. The results of mathematical modeling of range measurements to a target demonstrated that unlike the angular errors, the errors in range measurements due to the scintillation noise can not be greater than the physical dimensions of the object. Figure 1, references 4: 2 Russian, 2 Western.

#### **The Theory and Means for Algorithmic and Architectural Design of Digital VLSI Circuits**

937K0111G Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
In Russian Vol 35, No 5-6, May-Jun 92 pp 14-28

[Article by A. A. Prichozhiy, V. G. Brich; UDC 621.377.061]

[Abstract] The problem of equivalent transformations of a computation algorithm is examined in this article. It also deals with its incorporation in a digital circuit in accordance with an optimization criterion and requirements to the parameters. Models and methods are proposed for automatic transformation of the adaptation operators, composite sequential and parallel, conditional and cyclic operators and their combinations. Problems are also discussed of reducing the algorithm to a partially determined vector logic function and the algorithm synthesis by the vector function. A mechanism is developed for incorporating the operators and the entire algorithm into the architecture of a digital VLSIC and also a mechanism for equivalent transformations of the architecture, in order to reduce its complexity. The developed theory is used as a base for software included in the CAD system of digital VLSIC which uses the VHDL and MG3 languages. Figures 7, tables 4, references 13: 8 Russian, 5 Western.

#### **Compression of Bio-Medical Signals by Coding the Transformants**

937K0111H Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
In Russian Vol 35 No 5-6, May-Jun 92 pp 53-59

[Article by Joseph Svatosh, Czech Technical School of Higher Learning; UDC 621.372.001]

[Abstract] Requirements to the computer memory for recording biomedical signals are examined. A review is made of methods for compression of biomedical information. These methods were developed by the author for transformation of signal codes. Advantages are demonstrated of discrete cosine transformation methods, where reduction of the data vector length is limited only by discernibility requirements of diagnostic features of the bio-signal. A modified transformation method of the bio-signal's codes is discussed. Figures 3, tables 4, references 8: 1 Russian, 7 Western.

**Scattering of the Solar Microwave Radiation by the Irregularities of Perturbed Sea Surface**

937K0138A Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 38, No 2, Feb 93*  
pp 273-278

[Article by M. V. Danilychev, A. V. Yevtushenko, B. G. Kutuza, A. I. Lotov, A. G. Nikolayev; UDC 551.46.0:629.78]

[Abstract] Experimental results are examined of studies dealing with the relationships which govern quasi-specular scattering of natural microwave noise signals by irregularities of the sea surface. The results were obtained during the summer expedition (Jun-Jul 1990) of the RAS Institute of Radio Engineering and Electrotechnics using an oceanographic platform. The 16 m high platform was positioned at the outlet of a wide semicircular bay at about 600 m from the shore. The equipment consisted of a radiometric set designed for developing remote sensing methods and for conducting satellite supported measurements within the framework of "Priroda" project. The studies were conducted in the "Solar path" mode, when the Sun zenith angle was not smaller than 45° and consisted of constructing the "path" cross section in the zenith direction. Data about the intensity of solar radiation, atmospheric condition and the parameters of sea surface agitation were correlated with each "path". After generalizing and normalizing, the results were represented as a function of wind intensity and dispersion of slopes of large waves. The results of the study indicate that the solar illumination can cause significant distortions in the description of the sea surface temperature and other parameters of the ocean - atmosphere system. Quantitative estimates of these distortion were obtained. Figures 4, references 4: 2 Russian, 2 Western.

**Computation of Signal-to-Noise Ratio for a Radar Station Operating by the Method of Double Spectral Analysis of the Noise Signal**

937K0138B Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 38, No 2, Feb 93*  
pp 278-286

[Article by N. N. Zalogin, A. A. Kalinkevich, K. L. Kirillin; UDC 621.391.01]

[Abstract] Signal-to-noise ratio is computed for a radar station operating by the method of double spectral analysis, taking into account the radar parameters in the case of a finite time of the analysis. It is demonstrated that additional noise is generated due to the selected method of signal processing. The characteristic feature of the method is the fact that if the received input power is significantly greater than the level of the receiver intrinsic noise, the value of the signal-to-noise ratio is approximately constant and is determined by the signal base; that is, the increase of radiated, and correspondingly, the received power, may not cause the signal-to-noise ratio to increase above a certain level. Curves

are provided showing the signal-to-noise ratio vs. range to a target, and curves showing the signal-to-noise ratio as a function of the spectrum analyzer noise filter bandwidth. Figures 5, references 6: 3 Russian, 3 Western.

**Low Frequency Fluctuations in the Millimeter Range Harmonics Oscillator Built With Gunn Diodes**

937K0138C Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 38, No 2, Feb 93*  
pp 334-341

[Article by I. A. Kravtsov, A. V. Meshcheryakov; UDC 621.382.029.64]

[Abstract] Low frequency modulation noise of a Gunn oscillator operating in a biharmonic mode is analyzed. Expressions are obtained for spectral density of the amplitude fluctuations and the oscillation frequency. It is demonstrated that the frequency noise level depends on the fluctuation intensity of the diode admittance and the loaded Q-factor of the oscillating circuit at the frequencies of the first, as well as the second harmonic. Fluctuation characteristics of the Gunn oscillator which has outputs at the frequencies of the first and the second harmonic are examined experimentally, and curves of the energy spectrum of frequencies oscillations are provided. Figures 4, references 16: 7 Russian, 9 Western.

**Field Effect Transistors With a Low Modulation Sensitivity for Low-Noise Microwave Devices**

937K0138D Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 38, No 2, Feb 93*  
pp 346-355

[Article by Yu. M. Bogdanov, A. B. Pashkovskiy, A. S. Tager; UDC 621.373.01]

[Abstract] It is demonstrated that the doping profile of field effect transistors with Schottky barrier (SFET) and FET on heterostructures with a selective doping significantly affects the modulation of source - gate capacitance by primary low-frequency fluctuations of current and charge in the transistor channel, which to a great extent determines the level of the phase modulation noise in the microwave devices. This effect has been studied theoretically taking into account nonlocal dynamics of the electrons and the fringe effects using transistors with different length of the gates. Measurement results are provided of noise characteristics of oscillators and amplifiers employing SFET which were constructed based on these computations. Compared to similar devices built with regular SFET, the phase noise level in oscillators was reduced by a 6...12 dB, and a 10...15 dB reduction was achieved in amplifiers. Reduction in the amplitude noise was 15...20 dB. Figures 8, references 10: 6 Russian, 4 Western.

### Violation of the Coherence of Millimeter Radiowave Beam in the Near-Earth Turbulent Atmosphere

937K0116A Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 12, Dec 92 pp 2113-2119

[Article by A. S. Zakharov, V. A. Timofeyev; UDC 621.371:551]

[Abstract] Double-frequency space-time function of mutual coherence of the millimeter range radio waves in the turbulent boundary layer was examined. The relationship between the coherent properties of the radiation and the wave beam parameters, the path characteristics and the conditions of propagation was analyzed. Numerical analysis was performed with a smaller than 2 percent relative error using a EC-1061 computer. In order to account for the "saturation" of the refraction index fluctuations in the large scale region, a two-parameters Karman spectrum was employed. The frequency band was determined where the near-Earth atmosphere imposes no limitations on the spectrum width of signals used in radio systems. A comparison was made of the obtained results with the experimental data. Figures 5, references 10: 7 Russian, 3 Western.

### Computation of Surface Waves on a Metal Sphere and a Cylinder With Multilayer Radio-Wave Absorbing Material

937K0116B Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 12, Dec 92 pp 2134-2142

[Article by S. M. Nesterov, I. A. Skorodumov; UDC 621.372.8.01]

[Abstract] Based on an accurate solution of the diffraction problem, relationships are obtained for computing the amplitude components of the electromagnetic field scattered by a metal sphere and a cylinder with multilayer radio-wave absorbing material. Some selected results are provided of the surface waves contribution to the effective scattering area of a metal sphere and a cylinder, and also of a sphere and a cylinder with single layer coating. The proposed method can be applied for estimating the efficiency of the radio wave absorbing materials under different conditions and values of the coating parameters. Figures 5, references 6: 1 Russian, 5 Western.

### Electrodynamics of Planar Applicator Antennas With Semi-Transmitting Walls

937K0116C Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 12, Dec 92 pp 2149-2154

[Article by Ye. N. Korshunova, A. N. Sivov, A. D. Shatrov; UDC 621.372.8.01]

[Abstract] Two types of planar applicator antennas with a semi-transmitting radiation aperture are examined in this article: the out-going wave antenna, and the resonator antenna. The antennas are used for studying the effects of the electromagnetic fields in the microwave range on biological objects. The fundamental requirements to such radiators is to assure a specified field distribution on the surface of the radiation absorbing object and a good matching with the feeding circuit. Electromagnetic computations of these antennas parameters were carried out using the integral equations method. The developed mechanism makes it possible to study the penetration of the antenna field into the absorbing media. Results are described of optimizing the millimeter range antennas designed for treating biological objects. Graphs are provided showing the intensity of the electric field as a function of the penetration depth for different distribution laws of the aperture transmittance. Figures 5, references 2 Russian.

### Effect of Engineering Errors on the Characteristics of Pattern Forming Circuits Based on Surface Acoustic Waves

937K0116D Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 12, Dec 92 pp 2161-2168

[Article by A. V. Belyanskiy, V. G. Kartashev; UDC 621.396.67:534]

[Abstract] Methods are examined for computing the dispersion of random phase and amplitude errors generated during fabrication of pattern forming circuits for antenna arrays operating in the receiving mode with a small level of the pattern side lobes. The errors, discussed here, are caused by random position dislocation of interdigital transducers when preparing the templates and photolithography, nonuniform adhesion of the metallic film to the piezo-substrate, local non-uniformity of the piezo-substrate parameters and dissimilarity of the matching circuits connecting the pattern forming circuits on surface acoustic waves with the external devices. A theoretical analysis was made and statistical computer modeling of random errors by the Monte Carlo method was performed for checking the validity of the results and for establishing the applicability limits of the analytical method. An assumption was made with the theoretical analysis that the error distribution of the partial coefficients is normal. However, it was demonstrated that the resultant distribution of the side lobes level does not depend much on the type of the distribution used for describing the errors of the partial coefficients. Figures 4, references 4 Russian.

### Adaptive Bearing-Taking of Intensive Signal Sources in Multichannel Systems

937K0116E Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 12, Dec 92 pp 2199-2209

[Article by O. P. Cheremisin; UDC 621.396.67.01]

[Abstract] Algorithms for Bearing-finding of intensive radiation sources obeying a random time-modulation principle in a multi-channel receiving system with an antenna array were synthesized within the framework of the adaptive Bayes' approach. Application of adaptive methods for signal processing in multichannel systems is an effective method to increase the information yielding capacity of radar systems with antenna arrays under conditions of a priori uncertainty of recorded data. The well familiar Kaypon statistics and "Rayleigh ratio" were examined for applicability to solution of the bearing-finding problems. The efficiency analysis of the developed algorithms, augmented by the bearing-finding algorithm according to the "thermal noise" statistics, demonstrated that with a sufficiently large size of sampling, the best accuracy characteristic is exhibited by the algorithm based on the "Rayleigh ratio" statistics, and the worst characteristic is exhibited by the Kaypon statistics. The accuracy characteristic of the algorithm based on the "thermal noise" statistics lies between them. The quality of all examined algorithms depends only on the mutual position of the radiation sources in space and the degree of linear dependence of the amplitude-phase distribution vectors. References 8: 5 Russian, 3 Western.

#### Statistical Synthesis of Optimal Frequency Meters Based on Acousto-Optical Modulators

937K0116F Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 12, Dec 92 pp 2209-2215

[Article by V. I. Shcherbak, A. V. Parshutkin; UDC 621.396.662]

[Abstract] Based on the optimal, in terms of likelihood, algorithm for estimating the parameters of coherent optical waves, several possible versions of radio signal frequency meters employing acousto-optical modulators (AOM) were developed. Fourier-processors are normally used for wideband analysis of the radio signal parameters. However the area of their application is limited by the measurement accuracy of the carrier frequency, which comprises several hundred kHz, while the duration of the analyzed signal sample is a few microseconds. In order to eliminate this shortcoming an attempt was made to synthesize and to analyze the operating frequencies of an optimal frequency meter which uses an AOM. In the previously published reports by the author of this article an optimal algorithm for measuring the spatial parameters of coherent optical waves was developed by making assumptions that the input effect is approximated by an additive mixture of a quasi-determined signal and a white noise, that some reference value of the estimated parameter is known, and that a discriminator method of measurements is used. With these assumptions the likelihood function is approximated in the present article by a normal distribution and an algorithm is derived for the output effect of the generalized discriminator. Two possible realizations of this algorithm

for processing the optical wave after the AOM are examined: processing directly after the modulator, and processing in the focal plane of the Fourier-processor. Figures 4, table 1, references 6 Russian.

#### Methods and Resources for Complex Analysis of Mechanical, Electronic and Software Components of Production Equipment

937K0115A Moscow *VESTNIK MOSKOVSKOGO GOSUDARSTVENNOGO TEKHNIЧЕСКОГО UNIVERSITETA: SERIYA PRIBOROSTROYENIYE* in Russian No 3, Jul-Sep 92 pp 45-54

[Article by V. T. Ryabov; Bauman State Technical University, Moscow; UDC 621.01:621.38.681.3.06]

[Abstract] Fundamental properties of technological processes of developing the mechanical, electronic and software components of mechanisms, and the related concepts are discussed. When developing the technological equipment, the process and service model is worked through and detailed. The fundamental concept of the approach to the well coordinated development of the mechanics, electronics and software, which is described here, is a step-by-step process. The process and construction of an adequate model, based on uniform methodological principles is described and illustrated by an example of a technological system. The system consists of several technological stations, serviced by a two-handed robot. When work is completed at any of the stations, the robot shifts its position and the product arrives at the output storage. In order to describe the interaction between the step-by-step processes, their paired relationships are defined. These four types of interactions help to organize very developed units from the step-by-step processes, and to develop processor models. A diagram is provided of monocrystals growing process in a device, controlled from a central automatic control system. Figures 3, references 3: 2 Russian, 1 Western.

#### Adaptive Algorithms for Damping Short-Period Aircraft Oscillations. Longitudinal Motion

937K0115B Moscow *VESTNIK MOSKOVSKOGO GOSUDARSTVENNOGO TEKHNIЧЕСКОГО UNIVERSITETA: SERIYA PRIBOROSTROYENIYE* in Russian No 3, Jul-Sep 92 pp 76-88

[Article by P. D. Krutko, A.A. Malakhov, V. G. Chernyshev; Bauman State Technical University, Moscow; UDC 697.7.05.001]

[Abstract] A synthesis method of algorithms for damping a non-traditional structure exhibiting a weak sensitivity to the effects of external perturbing forces is described. This is achieved without identification, and without estimating the coordinates of the state and self-adjustment. The synthesis is based on the solution of the problem of minimizing the instantaneous values of the acceleration energy of the controlled variable. The minimized functional is formed in the neighborhood of the

motion trajectory of the standard model, whose dynamics characteristics correspond with the requirements to the dynamics of the designed system. Results of mathematical modeling are provided. Figures 4, references 5 Russian.

### **Distortion of Duration-Modulated Trapezoidal Shape Pulses in Single-Ended Amplifiers With Double-Sided Modulation**

937K0115C Moscow VESTNIK MOSKOVSKOGO GOSUDARSTVENNOGO TEKHNIЧЕСКОГО UNIVERSITETA: SERIYA PRIBOROSTROYENIYE in Russian No 3, Jul-Sep 92 pp 111-113

[Article by I. Bashta, Czech Technical School of Higher Learning, Prague; UDC 681.3]

[Abstract] In the single-ended amplifiers with a two-sided symmetrical modulation the spectrum distortion of the output signal in a form of combined components depends on the form of the modulated pulses. For rectangular pulses this problem was previously investigated, and in the earlier work by the author of this article, the pulse was approximated by a trapezoid. The present work describes the solution of this problem, which consists in some simplification of previously determined equations for the coefficients of nonlinear distortion and in their qualitative computer analysis. Theoretical estimates of nonlinear distortions in the single-ended amplifiers can be made based on these results with minimal experimental information on the duration of the pulse rise and drop. Figures 2, references 11: 9 Russian, 2 Western.

### **Conflict-Conditioned Gains in the Presence of Countermeasures**

937K0108A Moscow RADIOTEKHNIKA in Russian No 7-8, Jul-Aug 92 pp 3-6

[Article by V. L. Karkotskiy, V. M. Shlyakhin, Yu. V. Yakovlev; UDC 621.396.96]

[Abstract] The objective of this study is to determine the probability and time indicators of advantages of the opposing sides in a radar conflict, particularly for a situation when the radar side attempts not just to get ahead of the opponent, but also takes measures to avoid possible counteractions. In this situation the duration of the sides interaction, hence the time for achieving a gain is conflict-conditioned, i.e. conditioned by the actions of each of the opposing sides. Analytical relationships are determined of the average time of radar and countermeasure resources remaining in a losing situation with respect to the opposing side as a function of fundamental characteristics of the interacting sides. These analytical relationships make it possible to estimate the gains, taking into account the counteractions of the opposing sides. Figures 2, references 4 Russian.

### **Accuracy of Measuring Frequency and Direction of Radiosignal Arrival in Countermeasures Information Systems**

937K0108B Moscow RADIOTEKHNIKA in Russian No 7-8, Jul-Aug 92 pp 6-12

[Article by V. G. Radziyevskiy, O. V. Zheltoukhov; UDC 621.391.2]

[Abstract] Measurement accuracy of the carrier frequency and the direction of the signal arrival received in a noisy background with optimal and quasi-optimal processing under conditions when the shape of the desired signal envelope differs from the shape of the reference signal envelopes is analyzed. There are two type of measuring devices: devices where first the carrier frequency is determined and then this information is used for estimating the direction of the signal arrival, and devices where the carrier frequency and bearing are determined simultaneously. A comparison is made here between the performance of devices with sequential and simultaneous estimates of these parameters. It was demonstrated that the measuring systems with a simultaneous measurement of frequency and bearing are more effective than similar systems with preliminary estimates of the frequency. Differences in the effectiveness of measurements increase with increased signal base. Unlike systems with preliminary estimates of the carrier frequency, increasing the signal base doesn't affect much the quality of measurements in systems with a simultaneous estimates of the frequency and bearing. Figures 3, references 8: 6 Russian, 2 Western.

### **Efficiency of Radioelectronic Systems at Optimal Countermeasures With Employment of a Blocking Jamming**

937K0108C Moscow RADIOTEKHNIKA in Russian No 7-8, Jul-Aug 92 pp 20-23

[Article by V. V. Bykov; UDC 621.396]

[Abstract] When countermeasures are used against radioelectronic systems (RES), normally only incomplete information is available on the RES radiation parameters. When the uncertainty of these parameters (carrier frequency, bearing, etc) is small, aimed jamming is used, and when the uncertainty is great, blocking jamming is employed. Estimates of the guaranteed, corresponding to a worst case, radioelectronic system efficiency with a blocking jamming are made based on the solution of the problem of optimal non-parametric synthesis. In most cases, only a blocking jamming, covering the entire uncertainty region of the RES parameter is not optimal. More menacing for the RES is a semi-blocking jamming with a uniform power distribution in a optimally concentrated band, compared to the uncertainty interval of the RES radiation parameter covered by the jamming. The optimal degree of the jamming concentration and the efficiency gain from optimization depend on the jamming power and the type and parameters of the efficiency function. The smaller the jamming power is,



the more concentrated it must be. In the examined examples the gain in the jamming efficiency due to its optimization was on the order of 10 and greater. Figure 1, references 2: 1 Russian, 1 Western.

#### **Minimizing the Duration of the Radar-Search of a Target**

937K0108D Moscow *RADIOTEKHNIKA* in Russian  
No 7-8, Jul-Aug 92 pp 23-27

[Article by V. L. Karkotskiy, V. M. Shlyakhin, Yu. V. Yakovlev; UDC 621.396]

[Abstract] With a radar search in a conflict situation, when the radar attempts to be the first and at a farthest possible distance to detect the target which in turn attempts to be ahead of the opponent and to avoid detection, the time factors are most significant for winning by one of the opposing sides. In this article the feasibility is examined of minimizing the duration of the target search by using the radar adaptation to the noise situation. By selecting the spectral power density of the signals, the radar can regulate the time of the target search and reduce it to a minimum. The target can complicate the solution of this problem by slipping away from the search zone or by changing the type of countermeasures. Figures 1, references 7: 5 Russian, 2 Western.

#### **Efficiency Analysis of a Polarized Self-Balancing Potentiometer Under Conditions of Noise Interference With a Varying Angle of Polarization Ratio**

937K0108E Moscow *RADIOTEKHNIKA* in Russian  
No 7-8, Jul-Aug 92 pp 27-29

[Article by V. V. Skachkov, O. N. Kislitsin, V. V. Sergeyev; UDC 621.396.677]

[Abstract] Adaptive polarization filters which employ self-balancing potentiometers with correlation control circuits are used to suppress polarization correlated noise with a priori known parameters. A quantitative analysis is made here of the efficiency of a self-balancing polarization potentiometer operating under conditions of linearly polarized interference with a varying angle of the polarization ratio. Results of the noise compensation which were obtained by numerical integration are shown in graphs as a power ratio of the interference noise to the intrinsic noise at the potentiometer output for situations when the scanning frequency of the noise polarization plane was not greater than the pass-band of the integrating filter. The compensation efficiency of noise with a varying angle of the polarization ratio was also estimated using computer modeling. Figures 2, references 4: 3 Russian, 1 Western.

#### **Design Features of Effective Computing Systems for Digital Signal Processing Based on Systolic Processors**

937K0108F Moscow *RADIOTEKHNIKA* in Russian  
No 7-8, Jul-Aug 92 pp 31-37

[Article by V. A. Kostenko; UDC 621.372.54]

[Abstract] Application of systolic processors with contemporary methods of space-frequency-time signal processing and principal problems due to integration of systolic processors in the computation systems for digital signal processing are examined. A list is provided of fundamental signal processing operations with five subclasses of standard functional procedures. It is demonstrated that the efficiency of the systolic processors can be significantly increased with application of orthogonal memory. A standardized computer architecture is proposed for construction of a signal processing system based on a 4-port orthogonal memory, which allows to combine different type of systolic processors. Because of the modular design principle of the computation system, and feasibility of employing unit methods in the procedures of linear algebra, it is possible to select its configuration, to process arbitrary size data and to employ new type systolic processors. Figure 1, table 1, references 10: 8 Russian, 2 Western.

#### **Fast Algorithms for Decoding Reed-Muller Codes**

937K0108G Moscow *RADIOTEKHNIKA* in Russian  
No 7-8, Jul-Aug 92 pp 50-53

[Article by A. D. Kozhukhovskiy, A. A. Levashnikov, A. I. Litvin; UDC 621.391.15]

[Abstract] Algorithms for decoding Reed-Muller codes of the first order, RM-1, are examined. Methods based on fast algorithms of Walsh transformation are used for its effective computation. The fast algorithms for matrices multiplication are based on the feasibility of their factoring. Factoring of the Walsh-Adamar matrices for decoding Reed-Muller codes in a vector mode for computers with an "one command, many data" type architecture provides a gain in speed by a factor of 1.5 compared to other algorithms without significantly increasing the computer memory. References 10: 9 Russian, 1 Western.

#### **Algorithm for Adaptive Filtering and Bearing Taking of Interference Sources in a Phased Antenna Array System**

937K0108H Moscow *RADIOTEKHNIKA* in Russian  
No 7-8, Jul-Aug 92 pp 68-72

[Article by L. I. Byalyy, V. V. Podturkin; UDC 621.391]

[Abstract] An algorithm is proposed for adaptive spatial filtering (ASF) at the output of the pattern forming phased antenna array. In the presence of correlated noise, the ASF in the signal channel is accomplished



using compensation beams, which are selected from the totality of beams of the pattern forming circuit (PFC), according to instructions about the noise source location received from the outside. The algorithm for selecting the compensation beams is based on transformation of covariant matrix of the PFC beams intensity. Thus, it is possible to take bearing of the noise sources simultaneously with ASF, while the accuracy is equal to the half-width of the PFC beams. A significant feature of the ASF algorithm is feasibility of its realization without additional hardware expenditures and additional computer time based on arithmetic with a floating comma. Figure 1, references 5: 2 Russian, 3 Western.

### Scattering of a Wave Propagating Along an Impedance Surface With a Shield of Finite Dimensions

937K0102A Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 11, Nov 92 pp 1921-1927

[Article by Yu. L. Lomukhin, B. B. Damdinov; UDC 621.371:551.510]

[Abstract] Effects were examined in this article of a thin arbitrarily shaped, non-penetrable by radiowaves obstacle on attenuation of waves propagating along impedance surface. Using a spectral method, the results of solving the problem of wave propagation near a piece-homogeneous impedance surface with a one-dimensional diffracting obstacle were generalized for the case of the arbitrarily shape obstacle. Numerical and analytical results were obtained, which allow to evaluate the attenuation caused by a finite dimension shield on the absorbing surface. It was demonstrated that the attenuation value depends on the shield dimensions and the electrodynamic parameters of the surface. Specifically, it was established that a rectangular obstacle, introducing maximum attenuation together with an absorbing surface, has smaller transverse dimensions than with a conducting surface. The described method is also applicable when studying the effects of an arbitrarily shaped obstacle located near a plane absorbing surface with a finite curvature. Figures 5, references 7: 3 Russian, 4 Western.

### Radar Sensing of the Stratified-Heterogeneous Subsurface of a Planet

937K0102B Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 11, Nov 92 pp 1937-1948

[Article by V. A. Andrianov; UDC 621.396.96]

[Abstract] A radiopulse reflection from a heterogeneous dielectric medium is theoretically studied in order to analyze the feasibility of employing radar to solve geophysical problems dealing with the subsurface ground structure of a planet. A combination Cauchy problem corresponding to the presence of reflectors (in this case

the reflecting surface of a planet) is formulated. The solution of a one-dimensional wave equation in a form of the Fourier-Cauchy integral is analyzed for piece-homogeneous and continuously heterogeneous models of stratified media. The solution analysis for the piece-homogeneous medium (layer in a half-space) is carried out in a time and frequency domain for a ground without losses. Feasibility is demonstrated of determining the layer thickness and the dielectric permittivity of the layer and the half-space based on measurements of the radio-waves reflection coefficient in a wide frequency spectrum. The width of the spectrum depends on the layer thickness and its dielectric permittivity. Figures 5, references 9: 5 Russian, 4 Western.

### Computation of SAW Devices Simulating the Performance of Receiving Antenna Systems

937K0102C Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 11, Nov 92 pp 1959-1964

[Article by V. G. Kartashev; UDC 621.396.01]

[Abstract] The operating principles and design methods of surface acoustic wave devices which simulate the performance of receiving antenna systems are examined. Simulation of the receiving antenna operation by SAW devices is based on the principle that the electromagnetic and acoustic wave propagation is identical. This simulation makes it possible to test radio devices and radio systems without radiating the electromagnetic waves into space. Equidistant and non-equidistant interdigital transducers and the synthesis procedure of their topology are described. A stationary phase method is used for synthesis of the interdigital transducer topology which provides the required amplitude and phase-frequency characteristic. Figures 4, references 3 Western.

### Theory of Artificial Magnetic Materials Based on Circular Currents

937K0102D Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 11, Nov 92 pp 1992-2003

[Article by M. V. Kostin, V. V. Shevchenko; UDC 621.317.794]

[Abstract] An artificial spatial structure in an electromagnetic field whose wavelength is significantly longer than the dimensions of the structure's elements and the distance between them, exhibit properties of dielectric and magnetic media. A quasi-static theory of an artificial structure medium with elements in a form of circular metallic conductors is described. The structure exhibits diamagnetic properties and high magnetic losses in a wide frequency range with a small metal content. Simple analytic expressions are obtained for computations of the magnitude and position of the maximum losses in the frequency range. A feasibility of realizing an artificial

structural medium of non-magnetic materials with large magnetic losses and small volume of metal is demonstrated experimentally. Estimates are made of dielectric losses of the structural medium. Figures 6, references 17: 13 Russian, 4 Western.

### Electron Waves in a Relativistic Cherenkov Microwave Device

937K0102E Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 11, Nov 92 pp 2032-2041

[Article by V. M. Pikunov, I. A. Chernyavskiy; UDC 621.385]

[Abstract] A hierarchy of physical and mathematical models of the performance of Cherenkov microwave devices is used for their development and optimization. Different versions of the electron wave dispersion equation method based on linearization of the equation of motion and continuity of electron flux constitute an important tool for the analysis of such devices. In this article a Galerkin method is used to study the dispersion characteristic and the transverse structure of the electromagnetic field of electron waves. This method is applicable for studying the single mode devices as well as oversized delay structures; the fundamental parameters of a delay system and an electron flux can be selected, and the frequency regions of the flux and the DS synchronization can be determined with this method. Classification has been developed for electron eigenwaves of this kind of devices. Numerical results of computations of the dispersion characteristics and the transverse structure of the electromagnetic field are provided. The obtained data is compared with the data published in literature. Figures 5, Tables 2, references 10: 8 Russian, 2 Western.

### Optical Phasing of a Three-Element Radiointerferometer in the Centimeter Range

937K0102F Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 11, Nov 92 pp 2073-2083

[Article by N. A. Armand, V. P. Vardya, I. P. Korsunov, R. F. Matveyev; UDC 621.372.8.029.7:621.371.392:621.396.029.7]

[Abstract] A phasing system for local microwave heterodynes of a three-element radio-interferometer was proposed and implemented. The system is based on transmission of a reference microwave signal by an underground optical carrier for phasing local oscillators of a radio-interferometer in the centimeter range. The functional block diagram of this system connecting three antenna components separated by 173 and 288 meters is described. The lightguide is formed by a system of periodically located lenses for correcting the diffraction divergence of a highly coherent laser beam. The distance between lenses is about 100 m., making it possible to keep the diameter of the light beam on the order of 1 cm. The lightguide is

positioned underground, which increases the temperature stability of the medium and provides a high stability of the lightguide electric length (EL). An automatic long-time stabilization system of the optical beam spatial position in the lightguide is described. The system provides a stabilization accuracy on the order of  $\pm 0.05$  mm with a time constant of 2...3 sec. Comprehensive experimental study of a km long lightguide demonstrated that the seasonal relative stability of the EL is not smaller than  $(1.2-1.4) \times 10^{-5}$ , and that the short time stability is  $4 \times 10^{-7}$  per hour. The feasibility of predicting fluctuations of the EL lightguide from barometric and thermal data was demonstrated experimentally. Figures 5, references 8, 7 Russian, 1 Western.

### A Surface Acoustic Wave Filter for Satellite TV

937K0102G Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 11, Nov 92 pp 2103-2106

[Article by Ye. V. Bausk, I. B. Yakovkin; UDC 621.396.6]

[Abstract] Providing a low noise level at the input and a qualitative signal filtering of image and sound constitute a major problem in designing the receiving channel of satellite TV. By applying the technology of surface acoustic waves a prototype of a filter was developed in this frequency range, which may soon become one of the quantity produced acousto-electronic components. The fundamental specifications for its characteristic are as follow: central frequency  $f_0 = 479.5$  MHz, relative pass-band of about 6 percent, first sidelobes level of the frequency response not greater than -40 dB, second sidelobes level not greater than -35 dB, insertion losses  $< 20$  dB, variation of the group delay time  $< \pm 10$  ns. Since this filter is intended for quantity production, the cost factor is an important characteristic, which is determined by the dimensions of the acoustic line and adaptability to quantity production. Topology of the filter electrode structure using interdigital transducers, and curves of experimentally obtained frequency response and deviation of the group delay time from the constant value are shown in figures. Figures 2, references 4: 2 Russian, 2 Western.

### Bases for Developing a Signal Processing Language

937K0084A Kiev *IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA* in Russian Vol 35, No 11-12, Nov 92 pp 3-11

[Article by V. Ye. Bocharov, V. G. Galagan; UDC 681.325.5-181.4]

[Abstract] The fundamental design philosophy, a set of operators, semantics and syntax of an algorithmic language for digital signal processing are described. This is

a problem oriented, high level language, effectively employing typical algorithms for digital signal processing, with resources for debugging or modeling specialized digital devices. It involves a combination of computer programs and hardware for input-output of discrete signals. The resources of the signal processing language control their functioning and interaction. The results of studies using programs developed by the authors demonstrate the merits of constructing a language based on the concepts of a discrete signal as an indefinite sequence of real or complex numbers, the concept of time scales, current moment of time, etc. References 7: 1 Russian, 6 Western.

### **Simultaneous Filtering and Identification of the Type of Excitation Interval of Noisy Voice Signals**

937K0084B Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 35, No 11-12, Nov 92 pp 11-17

[Article by V. I. Gupal, S. Ya. Zhuk, Yu. A. Mamonov; UDC 621.391]

[Abstract] Based on the mechanism of composite random Markov processes, the adaptive algorithms for combined filtering and identification of the type of the excitation interval of noisy voice signals are synthesized in discrete time. The problem of a combined filtering and determination of the type of interval of the voice signal stability is reduced to a problem of a combined filtering of the expanded condition vector, which includes a continuous and a discrete component. Simple quasi-optimal filtering algorithm were obtained by gaussian approximation of a posteriori (empirical) probability density function. The developed filtering algorithms were tested by a combination of a real voice signal and a gaussian white noise. The signal-to-noise ratio was measured before and after filtering for algorithms with poly-gaussian and gaussian approximation of a posteriori probability density, and the results are listed in a table. It is shown that the algorithms based on the gaussian approximation of a posteriori probability density are inferior to the synthesized algorithms with poly-gaussian approximation in terms of signal-to-noise ratio, and in duration of transient processes to a new segment of stability. Figures 2, tables 2, references 4: 3 Russian, 1 Western.

### **A Method for Computing the Detection Characteristics of a Package of Coherent Pulses in the Background of Gaussian Noise**

937K0084C Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 35, No 11-12, Nov 92 pp 55-59

[Article by S. V. Yagolnikov, V. I. Shevchuk; UDC 621.391.01]

[Abstract] Qualitative characteristics of a detector of packages of coherent pulses which power is specified are

determined. The pulses are detected in a background of a random steady-state flow of mutually non-overlapping square-shaped noise pulses whose power is constant and who have a gaussian distribution of voltage amplitudes within the pulse. Expressions for computing the detector characteristics (probability of detection or a false alarm) under pulsed noise conditions were obtained. These characteristics can be used in a particular case for computations of detection probability or false alarm under conditions of a steady-state noise or for conditions without noise. Figures 3, references 6: 5 Russian, 1 Western.

### **Tomographic Methods for Combating the Reflections From Local Objects**

937K0084D Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 35, No 11-12, Nov 92 pp 62-64

[Article by V. I. Samoylenko; UDC 621.396.1]

[Abstract] Employment of a priori information on the antenna pattern (AP) allows to determine the spatial distribution of the effective reflections from local objects, invariant to changes of the AP parameters. Application of the "newness" filter (in place of subtraction) for compensation of the reflections, eliminates the effects of the receiving and amplifying radar channel parameters on compensation. Memorizing the video signals for each orientation of the AP when mapping the terrain and subtracting this signal when in the operation mode of detecting or guiding would be effective if the AP and the radar parameters were invariant. However, the contemporary radar, for example, the "Patriot" use phased antenna arrays for forming the AP, making it possible to change the AP by adaptive methods. This implies that the AP, as well as the video signals reflected from the local objects would be different in the mapping and operating modes and their subtraction would not produce the desired compensation effects. Therefore, not the video signals of reflections from the local objects, but the spatial distribution of the effective scattering surfaces of local objects must be evaluated and memorized when mapping the terrain. This approach significantly increases the efficiency of filtering the reflections from local objects and improves the detection of low-flying targets. References 1 Russian

### **An Algorithm for Filtering the Trajectory of a Maneuvering Target**

937K0084E Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 35, No 11-12, Nov 92 pp 12-18

[Article by A. M. Shloma, V. B. Kreyndelin, A. L. Terekhov; UDC 621.396.9]

[Abstract] An algorithm for estimating the coordinates of moving objects performing different maneuvers is developed. Many algorithms for the solution of this problem

have been developed before, but their application assumes solution of the problem of identifying the trajectory in real time, or that the trajectory parameters are precisely known. In real life, the trajectory parameters are frequently unknown and application of different identification methods can significantly complicate the trajectory filtering algorithm. The algorithm which is developed here employs a so called "enclosed" model of the maneuvering object trajectory making it possible to dispense with identification of the object parameters. A high accuracy of tracking a maneuvering target can be achieved with application of the "enclosed" model without identification of the trajectory parameters. References 7: 6 Russian, 1 Western.

#### **Detection of Group Point Targets With Random Parameters**

937K0084F Kiev IZVESTIYA VYSSHIKH  
UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 35, No 11-12, Nov 92 pp 18-27

[Article by V. Ya. Plekin, A. V. Krevetskiy; UDC 621.391.266]

[Abstract] The problem of detecting group point targets (GPT) with random parameters is solved in this article. Unlike the familiar approaches to detect the group point targets, this problem is treated here as a stage of a secondary processing of radar signals. It is assumed that the location of the group point targets can be limited to a particular continuously associated space (CAS), reflecting by its configuration the location geometry of the group point objects. The number of the point targets within the CAS may be random and is specified by a corresponding probability distribution function. Different detection algorithms are examined. They all employ a familiar procedure of spatial filtering of the original scene by a filter whose pulse characteristics conforms with the CAS configuration, and which consists of comparing the results of filtering with one or two threshold values. Analysis of the algorithm's difficulty indicates that for all examined situations, the number of required operations is independent of the initial scene dimensions, but is determined by the number of samples. Time consuming operations can be eliminated from the primary processing stage with application of the examined approach to the detection of the GPT. Figures 2, references 8: 4 Russian, 4 Western.

#### **An Algorithm for Direction Finding of Pulsed Signals**

937K0084I Kiev IZVESTIYA VYSSHIKH  
UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 35, No 11-12, Nov 92 pp 53-56

[Article by E. A. Maltsev; UDC 621.396.96]

[Abstract] When using high-resolution direction finding algorithms to determine the direction of arrival of pulsed signals, difficulties arise related to amplitude distortions

of the wave front vector, which reduce the accuracy and resolution of the algorithms. Application of wideband processing with an appropriate selection of its parameters can significantly reduce the pulse effect of signals on the algorithms characteristics. An approach is examined in this article, which makes it possible to reduce the pulsed signal wave front distortions by increasing potentially attainable accuracy and resolution of the direction finding algorithm by employing wideband phasing in the frequency domain. Since this approach requires a great volume of computations, a simplified version, whose efficiency was verified by experimental results, is also provided. Figure 1, references 2 Russian.

#### **Mechanisms of a Multiwave Interaction of High-Current Relativistic Electron Beams With Plasma. (Review)**

937K0083A Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 37, No 10, Oct 92  
pp 1729-1743

[Article by V. A. Balakirev, N. I. Karbushev, G. V. Sotnikov; UDC 533.951]

[Abstract] A review is made of the fundamental theoretical phenomena manifested by interaction of high-current relativistic electron beams with plasma systems. Linear and multiwave nonlinear theory is discussed, and the results of numerical computations are described. It is demonstrated that the interaction between a weak-current and a strong-current electron beam with a plasma waveguide exhibits a theoretically different character. At large values of the high-current parameter this interaction becomes multiwave, and the single-wave theory leads to qualitatively wrong results for the linear as well as for non-linear approximation. When the beam current increases, the frequency value, corresponding to the attainment of a maximum increment, shifts to the region where the electron beam overtakes the plasma wave, and the dependence of the maximum increment on the beam current becomes different. A simultaneous excitation of several waves in the plasma waveguide with energy beams on the same order of magnitude occurs during the interaction process, due to expansion of the resonant region. Figures 7, references 60: 59 Russian, 1 Western.

#### **Computation of Probability Distribution of the CM and MM Radiowaves Attenuation in Communication Links Taking into Account Various Atmospheric Phenomena**

937K0083B Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 37, No 10, Oct 92  
pp 1764-1772

[Article by V. N. Pozhidayev; UDC 621.371.3]

[Abstract] A review is made of studies reflecting the contemporary condition of the problem of computing the radiowaves attenuation over communication paths.



Problems of computing the average values of the radio-waves attenuation probability distribution due to various causes, as well as the intervals of possible variations of these distributions with respect to the computed average value are discussed. Statistics of the radio-waves attenuation over ground paths due to anomalies in the refraction index of air in the near ground layer of the atmosphere is examined. Figures 2, references 24: 12 Russian, 12 Western.

#### Wave-Front Dislocation in a Turbulent Medium

937K0083C Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 10, Oct 92 pp 1773-1777

[Article by T. I. Arsenyan, S. I. Kaul, P. V. Korolenko, S. A. Ubogov, N. N. Fedotov; UDC 621.371:535.4]

[Abstract] Results are provided of an experimental study of the wave-front structure. This study was conducted over an inclined near-ground path with a model set-up using a specially developed automated system based on a SM-1420 computer. A block diagram of the transmit-receive device is provided. This set-up was positioned at an elevation of 25 m above ground level, and a LG-215 He-Ne-laser was used as the radiation source. A polarized TEE<sub>00</sub> wave was examined. It was demonstrated that the value of the correlation zone decreases with increased turbulence over the path. Estimates were made of the conditions for appearance of helical phase dislocations on the wave front, depending on the intensity of turbulence. Figures 2, references 8 Russian.

#### Pulsed Radiation of a Circular Aperture Antenna, Excited by a Unit Current Impulse (Transient Diagram)

937K0083D Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 10, Oct 92 pp 1783-1787

[Article by L.G. Sodin; UDC 621.396]

[Abstract] A circular antenna with a uniform current distribution along its aperture is examined in this article. It is assumed that all points of the aperture are excited simultaneously. A generalization is made for a case when the current distribution is irregular. Explicit equations were obtained, which describe space vs time relationship of the circular antenna field of radiation when it is excited by a unit current impulse (transient diagram). The particular features of the transient diagram are analyzed and its physical explanation is provided. Computation of the transient diagram helps to obtain a space-time physical picture of the radiation process and to describe the radiation field propagation in different directions. Because of the simplicity of mathematical approximation of the transient diagram, a significant simplification of the field computations is achieved, compared to a spectral approach, when a sequential computation of the radiation integral in the particular

region, and a computation of the Fourier integral transformation are required. This method of analysis can be extended to other types of antenna, particularly to the linear antenna. The obtained results are also useful for describing the characteristic of an "electromagnetic missile". Figure 1, references 4: 2 Russian, 2 Western.

#### Optimization of Estimating the Coordinates of a Target by the Multipositional Radar System With Redundant Information

937K0083E Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 10, Oct 92 pp 1839-1846

[Article by S. T. Bagdasaryan, V. R. Khachaturov; UDC 621.396.96]

[Abstract] The feasibility of combining the estimates of identical vectors of a target condition in redundant location systems obtained by different methods is examined here. Linearized algorithms for maximum probable estimates of the vector of the target condition are obtained by a combined processing of the correlated output data from simple devices for optimal measurement of polar coordinates, which use a minimal sufficient number of samples. Common algorithms are defined for optimized determination of the target polar coordinates from data of three (two sufficient, one redundant) measurements of a two-position radar. A block diagram of the target polar coordinates meter is synthesized. An analysis is made of the effects of redundant measurements on the accuracy of estimates. The results of this work can be used as a base for a rational design of computing devices for multipositional systems for estimating target coordinates with redundant measurements of the signal parameters.

#### Kinetic Power of Transverse Waves of the Electron Beam

937K0083F Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37, No 10, Oct 92 pp 1854-1858

[Article by S. V. Bykovskiy, V. A. Vanke; UDC 621.385.6.01]

[Abstract] Expressions are obtained for kinetic power of transverse waves of an electron beam, taking into account changes in the longitudinal velocity and the magnetic field intensity along the interaction region. It is argued that for some type of interaction, changes in the energy of transverse oscillations occur because of the decrease or increase of the longitudinal kinetic energy of the beam, that is, the longitudinal velocity is not constant but changes. Furthermore, it is also argued that in the previously obtained expressions an erroneous assumption was made of a negative kinetic power, which is possible only in the case of a varying longitudinal velocity. In this paper, the familiar energy relationships



for the transverse waves of the energy beam are corrected, and expressions are obtained in a more general form. An analysis is made of the applicability limits of the obtained expressions for various types of the electron beams. References 4: 3 Russian, 1 Western.

**Some Trends in the Development of Studies of Ion Induced Photon Emission**

937K0083G Moscow *RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 37, No 10, Oct 92*  
pp 1874-1882

[Article by V. V. Gritsina; UDC 537.534.8;537.531]

[Abstract] A review is made of the contemporary state of studies of radiation emitted by the excited particles knocked out from the surface of solid bodies by medium energy ions. With ionic bombarding of solid bodies a glowing halo appears over the irradiated surface, due to radiation of knocked out excited particles. This phenomenon is called the ion induced photon emission (IPE). The principal directions of studying the IPE during recent years are examined. They are focused on the following: 1) Development of new methods for studying the IPE, such as Doppler shift of laser fluorescence, the coincidence method, a monochromatic recording of the halo, and reconstructive tomography. 2) Studies of spatial distribution of the excited particles. 3) Analysis of the effect of volumetric and surface properties of solid bodies and features of the electronic configuration of the

excitation state of the knocked out particles on several IPE parameters. 4) Searches for correlation between the IPE parameters and other secondary-emission phenomena (diffusion, secondary ion emission). Figures 4, references 63: 31 Russian, 32 Western.

**Study of the Flicker Fluctuations in an Oscillator**

937K0083H Moscow *RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 37, No 10, Oct 92*  
pp 1905-1910

[Article by L. M. Lifshits; UDC 621.373.121.01]

[Abstract] Studies of fluctuations generated by a low-frequency flicker noise are difficult because of uncertainty of the flicker noise physical model and complexities of analyzing multiplicative random perturbations in a non-linear system. In this paper the effects of flicker modulation is investigated by combining the statistical and quasi-harmonic linearization, and estimates are obtained of the energy characteristics of the modulated oscillating process. The obtained results are significantly different from the familiar results. The analysis demonstrated the unsoundness (in second approximation) of the hypothesis about quasi-static state of the flicker fluctuations in an oscillator. It can be assumed that the factors which are not directly related to the noise fluctuations produce an additional effect on the frequency stability of high quality oscillators. References 5 Russian.

**Two-Coordinate Laser Interferometers in Robotics Devices**

937K0080A Moscow IZMERITELNAYA TEKHNIKA  
In Russian No 4, Apr 92 pp 21-23

[Article by Yu. F. Zastrogin, O. Yu. Zastrogin; UDC 681.785.57]

[Abstract] Linear and angular changes in velocity and acceleration are the parameters that must be controlled in robotics devices. Different positioning methods using laser interferometers are employed in robotics devices. Feasibility of employing two-coordinate laser interferometers is examined here. A circuit and functions of a two-coordinate laser interferometer with a time delay is described. Circuits are also provided of a two-frequency laser interferometer for two-coordinate linear and angular positioning, and an interferometer for controlling the speed of motion along two coordinates. It was demonstrated that a laser interferometer can be employed to control the speed of motion along two coordinates, and also to control linear displacements. At angular frequency of  $\Omega = 100$  kHz, speeds of motion up to  $12 \times 10^{-2}$  m/sec can be measured with the laser interferometer with a relative measurement error of 1 percent. Figures 3, references 3 Russian.

**Optimal, Interference Protected Method for Measuring the Frequency of Harmonic Signals**

937K0080B Moscow IZMERITELNAYA TEKHNIKA  
In Russian No 4, Apr 92 pp 50-52

[Article by M. Ya. Mints, V. N. Chinkov; UDC 621.317.373(088.8)]

[Abstract] A method for determining the frequency of a harmonic signal based on the standard deviation criterion is examined in this article. Application of this method for additive gaussian noise non-correlated with the signal, produces minimum dispersion of error for a specified noise level, and provides high noise protection due to employment of all non-correlated instantaneous signal value parameters over the time interval of measurements when making the estimates. This method, unlike the others, allows the time interval to be non-multiple of the signal period. No operation of separating the signal period is required with this method, which makes it possible to eliminate one of the dominating components of the instrumental error of measurements. Algorithms for signal processing were obtained and the errors of the method were estimated. Experimental studies were carried out by modeling the algorithms for computer processing and by testing a laboratory model of a multiprocessor multimeter. The results of processing multiple measurements of the error estimates were compared with the experimental errors of the best domestic frequency meter ChZ-64 used for reference and the computation error of the HP-5345 frequency meter. With a large number of measurements, the error of the developed meter was by an order of magnitude smaller. Figures 2, references 2 Russian.

**A Wattmeter M3-81 for Pulsed High-Power Microwaves**

937K0080C Moscow IZMERITELNAYA TEKHNIKA  
In Russian No 4, Apr 92 pp 55-56

[Article by R. Y. Baltushis, M. Y. Dagis, A. V. Mylnikov, R. B. Simniskis; UDC 621.317.382]

[Abstract] Microwave signals with a pulsed power greater than  $10^6$  Wt are commonly used for different applications. However, the mass produced domestic wattmeters can only measure powers up to  $10^{-1}$  Wt and 15-25 percent error. Attenuators or couplers for extending the upper limit of measurements increase the error. Methods for constructing a new wattmeter M3-81 to measure medium and large level pulsed microwave power are examined here. Engineering characteristics of the M3-81 wattmeter are provided. The greatest problem in measuring high power lies in metrological service of the wattmeters. There are no reference instruments for measuring pulsed high-power microwaves and no powerful generators of standard signals available. Because of this situation, calibration and checking of the wattmeter M3-81 must be made by comparing the indications of the M3-81 wattmeter with a reference medium power wattmeter using a comparator. For this purpose, a semiconductor diode which is connected through a directional coupler and an attenuator, and a non-standard high-power microwave generator operating in a pulse mode as well as in a CW mode is used. Figures 3, references 8 Russian.

**A Digital Kilovoltmeter for X-Ray Apparatuses**

937K0080D Moscow IZMERITELNAYA TEKHNIKA  
In Russian No 4, Apr 92 pp 59-60

[Article by O. A. Akatkin, V. P. Fedorov; UDC 621.317.725.027.3:621.386.2]

[Abstract] Digital kilo-voltmeters with microcomputers and sensors are used for measuring voltages below 100 kV in tubes of X-ray apparatuses operating in the loaded mode. The sensors are made with two p-type silicon photo-transducers, which are protected by screens, unequally attenuating the X-ray radiation. The voltage value is determined from a relationship, which is a function of discrete attenuation parameters of the attenuating beams. Since these parameters are ambiguously related to the measured voltage, that is, the identical values of these parameters can correspond to different voltages, errors can occur with measurements. In order to eliminate this ambiguity we developed a digital kilovoltmeter with a sensor based on a multi-element p-type silicon photo-transducer which attenuates and at the same time records the X-ray radiation. This kilovoltmeter and the principles of its operation is described here. The electronic recording system employs an analog-digital type VLSI circuit K572PV4 incorporating an eight channel analog multiprocessor, an analog-digital converter, a static operation memory, a control system and a buffer register for interfacing the system's memory

with the MK-61 type micro computer. Figure 1, references 5: 4 Russian, 1 Western.

### Scattering of Electromagnetic Waves by a Periodic Lattice of Microstrip Conductors on an Anisotropic Substrate

937K0079A Moscow IZMERITELNAYA TEKHNKA  
in Russian No 2, Feb 92 pp 45-46

[Article by V. A. Baregamyayn, V. F. Kravchenko, V. V. Kravchenko; UDC 621.396.67.01]

[Abstract] There is great interest in the use of anisotropic materials, for example, sapphire, in UHF measurement equipment. A model is examined using a method presented in other articles. An anisotropic single-axis crystal is placed between a lattice and a metal screen. The lattice is made of an infinite number of infinitely thin, ideally conducting metal strips. A plane wave which is arbitrarily polarized falls on the lattice at an angle. The diffraction field consists of a spectrum of E and H polarized waves. Strict boundary conditions are stated, and the amplitude of the incident wave is defined. Simplifying assumptions are made. The diffraction field can be expanded into a Fourier series. The total field for E and H polarized waves over the lattice and in the crystal are defined. The boundary conditions for the screen are defined. A system of equations is developed for E and H polarized waves both in the metal and in the gap. A system of linear algebraic equations is obtained for the coefficients of reflection and transmission and the amplitude of the diffraction harmonics of E polarized waves. Solving the system, another system of linear algebraic equations is obtained. The coefficients of reflection of E and H polarized waves are determined from this second set of equations. It then becomes possible to determine the power, energy density, and other characteristics of the examined physical model. Figure 1; references 17: 16 Russian, 1 Western.

### Statistical Characteristics of the Errors of Phase Measurements Due to Harmonic Noise

937K0079B Moscow IZMERITELNAYA TEKHNKA  
in Russian No 2, Feb 92 pp 47-48

[Article by A. M. Gladkiy; UDC 534.088:519.25]

[Abstract] When the phase shift between signals is measured, the signals contain a noise component which may adversely affect the measurement accuracy of digital phase meters. The statistical properties of these errors have been insufficiently studied. This is due to the problems of calculating the envelope and phase of a mixture of signal and noise with a relatively wide band of frequencies, as well as the error distribution function, which is a complex function of several random arguments. This article presents the results of studies of the statistical characteristics of the error in measuring phase differences from random harmonic noise. The results were obtained using a method of statistical computer

modeling. A model of an idealized phase detector was used. The absolute error of measuring the phase difference was calculated as the difference between the measured and true values of the phase shift. The mathematical expectation of error was estimated by averaging the absolute error of phase differences. The RMS error was estimated by averaging the squares of the centralized values of errors in 100-10,000 implementations of the initial data for each value of the measured angle. A BESM-6 computer was used to implement a program written in a version of ALGOL for the BESM computer. The RMS error is determined by the frequency of noise, the mathematical expectation of its amplitude, and the value of the measured angle. The dependence of error on noise frequency is studied. As the frequency of noise increased, the parameter which determines the mathematical expectation of the noise amplitude increased according to a nearly linear law. When the noise frequency changes significantly, the dependence of the RMS error on the measured angle also changes dramatically. One and two detector schemes are compared. Studies over a wide range of frequencies and noise levels show that as the level and frequency of noise increases, the density of the distribution of the absolute error approaches a uniform distribution. Figures 2; table 1; references 11 (Russian).

### Operational Features of Measurement Devices in Automated Instruments To Control and Protect Energy Systems

937K0079C Moscow IZMERITELNAYA TEKHNKA  
in Russian No 2, Feb 92 pp 55-56

[Article by N. I. Ovcharenko; UDC 621.319.44:621.382.233.026.072]

[Abstract] Measurement devices in automated instruments to control and protect energy systems are based on information on constrained components of voltage and current. Information is processed by elements which compare the amplitude or phase of two signals. A change in frequency is usually converted into a change in amplitude or angle in the phase shift of two compared signals. The main advantage of measurement devices based on phase comparison is speed. Amplitude and phase error is determined, and it is found that the phase error is substantially smaller than the amplitude error. Error increases as the absolute values of the compared values decrease. For additive error and a uniform law for the distribution of the densities of probabilities of amplitude and phase values, the number of distinguishable values of the informative parameter, which is virtually inversely proportional to error, defines the information capacity of the amplitude and phase comparison elements. There is less error when phases are compared, or for identical error levels, phase comparison requires less information. Other advantages of phase comparison are outlined. The use of phase comparison in analog and digital measurement devices is described. Some examples of the use of amplitude comparison are given. Figures 2; references 16 Russian.

**Features of the Recording of Probe Activity in Aerosol Radiometry**

937K0079D Moscow IZMERITELNAYA TEKHNIKA in Russian No 2, Feb 92 pp 60-63

[Article by S. K. Belkina, A. I. Pizin, and D. Ye. Fertman; UDC 541.182.2/3:539.16.08]

[Abstract] When the bulk activity of aerosols of long-lived radionuclides is measured, the final result of measurement is directly dependent on careful selection of the detector of ionizing radiation and methods of discriminating interfering radiation measurements. The selection of a detector is mainly based on the measurements to be made and the problems to be solved. For example, measurement of  $\alpha$  radiation places different demands on the detector than the measurement of  $\beta$  radiation. A table lists types of detectors used for  $\alpha$  and  $\beta$  radiometry, as well as notation of the type of detector (e.g., semiconducting or scintillation detectors) and the area of the sensitive surface. The  $\beta$  detectors are mainly scintillation detectors or Geiger counters. Mylar sheets are used to protect most detectors from radioactive contamination. The advantages of semiconductor detectors are outlined. Scintillation and gas discharge detectors are still preferred in the study of  $\beta$  and  $\gamma$  radiators. Price comparisons are made for semiconductor detectors. Successful work to develop detectors based on polystyrene (with surfaces up to 1600 cm<sup>2</sup>) is noted. Current methods used to enhance discrimination are discussed. The pros and cons of the methods are outlined. Key features of individual models are described. Figures 2; tables 2; references 24: 10 Russian, 14 Western.

**Possibilities of Using Analog Parallel Structures for Investigating Some Properties of Neuro-Like Information Acquisition and Processing Systems**

937K0127A Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 6, Nov-Dec 92 (manuscript received 12 Aug 92) pp 31-34

[Article by E. E. Rode and Ya. Ya. Vemanis; UDC 681.3]

[Abstract] The Komposit Scientific Industrial Association in Moscow developed two specialized coprocessors, the OMEGA-3/128D and OMEGA-3/256, oriented to solving nonstationary boundary problems. They are designed to be used with AT type personal computers. The OMEGA-3/256 has 256 nodal processors on 16 modules housed in a mini-tower. A nodal processor consists of GX, GY and GT conductance-code converters and a code-voltage-current converter. The OMEGA-3/128D has 128 nodes, but the nodal processor has two additional links, GD1 and GD2, to adjacent nodes. Figures 6; references 4: 1 Russian, 3 Western.

**Automated Readout of Information From Analog Fourier Processors**

937K0127B Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 6, Nov-Dec 92 (manuscript received 18 Aug 92) pp 35-37

[Article by V. N. Minin and A. M. Kiryukhin; UDC 621.317.44(088.8)]

[Abstract] A laboratory model of a device for reading output from Fourier processors, using surface acoustic wave dispersion delay lines, was developed. All circuits were built with digital components. A 6-bit analog-to-digital converter was used for input. The maximum converter coding frequency was 120 MHz. The device allowed processing, with no omissions, Fourier processor output signals with a width of 10 to 40 ns varying in an amplitude range of 30 dB. Figures 2; references 4 Russian.

**Forecasting the Execution of Complex Program Sets With Parallel Computing Systems**

937K0126A Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 12, Dec 92 pp 148-154

[Article by P. P. Bocharov, Yu. V. Preydunov; UDC 681.324:519.21]

[Abstract] Using original mathematical methods the problem of forecasting and estimating the execution time of specific program sets in a parallel computing system (CS) with a specified or assumed configuration of computing resources is formulated and solved. The known or expected capacity of the computation resources is taken into account and non standard parameters of the sets of interrelated programs for parallel processing are applied. The concept of forecasting the execution of a complex set of work stands to mean a priori stochastic estimates of time needed for its realization with a parallel computing system, and the likelihood of its execution during time which is not longer than the specified "instruction" time. The following practical applications and interpretations of the forecasting problem are possible: determination of the "suitability" of parallel CS for solution of a specified class of problems before making the final selection of its structure and configuration; selection of the parallel CS configuration and the required capacity of the computation resources for solution of the particular class of problems during a specified time. Figures 3, references 9: 5 Russian, 4 Western.

**An Optical Multiprocessor Computing System Controlled by the Data Flow**

937K0119A Novosibirsk AVTOMETRIYA in Russian No 2, Mar-Apr 92 pp 3-10

[Article by V. A. Kostyukov, V. P. Torchigin; UDC 681.323:535]

[Abstract] The feasibility is examined of developing a computer system which is controlled by a data flow. This system is based on an optical multiprocessor computing complex (MPCC), whose operating time is distributed among thousands of virtual processor elements. It is demonstrated that the difficulties of contemporary computing systems, related to a relatively long time of signal distribution among the logic elements can be surmounted by application of the examined method. Optical MPCC systems with SIMD architecture were previously discussed by the author of this article. The Connection Machine of the "Thinking Machine" company is a typical representative of an optical MPCC with SIMD architecture. Implementation of the Connection Machine as a vector computer has many advantages and it is shown here that the vector approach can be used for organizing MPCC with MIMD architecture. The fundamental difference between the optical MPCC with SIMD and MIMD architecture lies in the structure of the processor elements. The advantages are discussed here of the optical MPCC with MIMD architecture over SIMD architecture and a block diagram of a simple structure of an optical MPCC with MIMD architecture for a three-address command system is provided. Figures 2, references 6: 4 Russian, 2 Western.

#### Organization of Purely Optical Communication Media in Multiprocessor Computing Systems

937K0119B Novosibirsk AVTOMETRIYA in Russian  
No 2, Mar-Apr 92 pp 11-16

[Article by V. P. Torchigin; UDC 681.323.535]

[Abstract] The feasibility is examined of organizing communication networks based on different types of ultra-high-speed purely optical logic elements employing relatively long interaction of short optical pulses while they propagate along nonlinearly connected lightguides. Implementation philosophy and properties of different logic elements are examined along with the methods for constructing different types of communication networks. A full set of logic functions can be realized with the optical logic elements. The particular circuit-engineering feature of these elements lies in that the pulse repetition period of the processed logic pulses is by a factor of  $10^2$  -  $10^4$  shorter than the delay in obtaining the resultant output signals. It is demonstrated, that an optical communication processor can be constructed using wide-band logic gates with relatively long delays, which would perform the communication network functions, consisting of N processors, where N is the ratio of the element delay time to the optical logic signals period of arrival. The number of communication lines needed for constructing such communication network is by a factor of N smaller than when employing the regular methods. Figures 3, references 3: 1 Russian, 2 Western.

#### Circuit-Engineering Problems of Designing Fiber-Optical Systems for Inter-Processor Communication and Switching for Super-Computers

937K0119C Novosibirsk AVTOMETRIYA in Russian  
No 2, Mar-Apr 92 pp 29-36

[Article by A. A. Verbovetskiy, I. A. Shilov; UDC 681.327:681.7]

[Abstract] Structural, circuit-engineering and construction solutions based on fiber-optics technology are proposed for designing passive inter-processor communication and switching systems (IPCSS) for a super computer. Single-wave versions of systems are examined, as well as systems with spectral multiplexing of information, designed for switching large numbers of central processors and memory devices. Estimates are made of the principal parameter of these systems, which indicate that the IPCSS with spectral multiplexing of information can simultaneously and independently switch, using the "each-to-each" principle, up to  $10^4$  processors with  $10^4$  memory devices at the data transmission rate on the order of 1000 Mbit/sec. A block diagram for construction of a compact single-wave optical IPCSS is provided. Depending on the engineering specifications of the super computer IPCSS, and the availability of components for its construction, a suitable IPCSS circuit can be selected from the circuits which are proposed in this article. Figures 6, references 7: 1 Russian, 6 Western.

#### Application of the Redundant Variables Method With Parallel Computing Processes of Digital Systems

937K0119D Novosibirsk AVTOMETRIYA in Russian  
No 2, Mar-Apr 92 pp 78-82

[Article by A. I. Litvin, N. V. Molchunov; UDC 519.6:681.3]

[Abstract] The redundant variables method in parallel computing processes of digital systems based on vector-matrix operations is examined in this article. Construction of an orthogonal discrete Walsh transformation is used as a model problem. It is demonstrated that the redundancy causes no deterioration of the algorithm's parallel properties. Malfunctions in the performance of digital systems can be detected by control measures, and the control methods are described. At the price of a small redundancy, the reliability of parallel computations can be increased by applying the method of redundant variables. Table 1, references 7 Russian.

#### A Trellis Coding Scheme Based on Splitting of Signal Alphabet

937K0100A Moscow PROBLEMY PEREDACHI  
INFORMATSII in Russian Vol 28, No 4,  
Oct-Nov-Dec 92 pp 14-23

[Article by K. Sh. Zigangirov, R. Yokhannesson; UDC 621.391.15]



[Abstract] This article deals with the problem of effective selection of transformations of code sequences into signal sequences. With a classical construction of transmitters, J-th sequences from decoder output are directly transformed into J-th signal sequences which are transmitted. The received signal is applied to a decoder, and the decoder makes a decision on the transmitted sequence. A signal-code construction is proposed, providing a better relationship between the reliability and complexity of decoding than the classical scheme. The coder breaks up into several "elementary" binary convolutional coders, and the decoder into several Viterbi decoders, while each of the decoders begins decoding after the higher order decoders have completed the decoding, which causes delays. The delay can be reduced by applying sequential decoders. The proposed method of splitting the alphabet is a version of the Ungerboeck and Ginsburg scheme. References 8: 3 Russian, 5 Western.

#### Transmitting Capacity of a Communication Channel With Internal Random Coding

937K0100B Moscow *PROBLEMY PEREDACHI INFORMATSII* in Russian Vol 28, No 4, Oct-Nov-Dec 92 pp 24-34

[Article by V. I. Korzhik, V. A. Yakovlev; UDC 621.391.1:519.2]

[Abstract] A relationship is obtained for transmitting capacity of an expanded channel, consisting of sequential connection of the internal random code and a binary symmetrical channel. It was demonstrated that the information on the spectrum of the adjoining class of codes and some sub-codes is needed for its computation. The results applicable to the transmission systems with noise immune coding and broadcasting systems with hostile participants are analyzed. It is demonstrated that if the internal coder, which is used for a noise immune coding, does not provide the specified quality of the information transmission along binary symmetrical channels, using additional external coding or changing the internal code parameters can increase the noise immunity. Figures 4, references 12: 4 Russian, 8 Western

#### Interpolation of Discrete Periodic Data

937K0100C Moscow *PROBLEMY PEREDACHI INFORMATSII* in Russian Vol 28, No 4, Oct-Nov-Dec 92 pp 60-68

[Article by M. G. Ber, V. N. Malozemov; UDC 621.391.1:519.27]

[Abstract] The problem of reconstructing discrete periodic data on a small grid from known values on a large grid is examined in this paper. Sum of squares of finite differences in the r-th order is used as a smoothing functional. An explicit scheme is proposed for the solution of this problem, based on the application of the discrete Fourier transform, and the behavior of the solution when r approaches infinity is discussed. References 7: 1 Russian, 6 Western.

#### Varshamov-Tenengolts Codes and Bassalygo Hypothesis

937K0100D Moscow *PROBLEMY PEREDACHI INFORMATSII* in Russian Vol 28, No 4, Oct-Nov-Dec 92 pp 106-108

[Article by D. N. Gevorkyan, G. A. Kabatyanskiy; UDC 621.391.15]

[Abstract] Problem dealing with binary codes which correct single localized errors are examined. In previously published reports L. A. Bassalygo proposed a hypothesis that the maximum "power" (number of messages) of such code is equal to the integer part of the corresponding value of the Hemming boundary. Using Varshamov-Tenengolts codes it is demonstrated that this hypothesis is valid if the code length is  $n = p - 1$ , where p is a prime number, such that 2 is its primitive root. Figure 1, references 5 Russian.

#### Application of the Lie Groups for Programmed Control of Airplane Flight

937K0099A Kiev *AVTOMATIKA* in Russian No 6, Nov-Dec 92 pp 26-33

[Article by V. I. Legenkiy; UDC 681.51]

[Abstract] The problem of providing aircraft pilots with a suitable program for execution of a maneuver is discussed. For a purposeful change of the aircraft position in space, the motion of its center of mass must be programmed. The pilot or the automatic control system carry out the specified program by performing the appropriate control functions. The meaning of the quantity and "quality" of the motion programs is examined. The number of motion programs can not be greater than the number of control functions. The question of what constitutes the best representation of a program is discussed. A program appropriate for execution by an automatic control system may not be appropriate for execution by a pilot-operator. For improving the quality of flying, the design of the flight programs must be guided by the stability concept of the operator performance, and consequently by the stability principle of the dynamic properties of information. It is proposed that for realization of this principle, the motion programs provided to the pilot-operator must be in terms of first integrals of the corresponding realizations of the equations of motion. The justification of this position and an example of its application are discussed. References 17: 15 Russian, 2 Western.

#### Adaptive Guidance of a Controlled Object to a Maneuvering Target

937K0099B Kiev *AVTOMATIKA* in Russian No 6, Nov-Dec 92 pp 39-44

[Article by S. Ya. Zhuk, I. V. Mekhedov; UDC 621.396.6:681.3]

[Abstract] Linear models with a random structure are widely used to solve the problem of secondary processing of radar information, and the estimates of the parameters of the target motion are applied to formulate the guidance concepts of controlled objects. However, the guidance algorithms do not take into account all the features of the model. In the previously published study a quasi-optimal algorithm for a feedback control of linear discrete dynamic system with a random structure was synthesized in real time, where, to minimize the residual extrapolated risk the discrete Rikkati equations must be solved in a reverse time, which significantly increases the computation cost. In the present work a division method and the ambiguity theory were used to solve the control problem of a linear discrete dynamic system with a random structure. Sufficiently simple and effective quasi-optimal algorithms for adaptive control operating in the real time mode were obtained. Comparison of the these algorithm with the previously developed and more accurate was made by a statistical computer modeling. It was demonstrated that it provides similar guidance characteristics but requires fewer computations, making it more preferable for practical applications. Figure 1, references 5 Russian.

#### **Consecutive Learning Procedures Which Guarantee the Quality and Reliability of Image Recognition**

937K0099C Kiev AVTOMATIKA in Russian No 6,  
Nov-Dec 92 pp 64-69

[Article by V. I. Sushko; UDC 681.513]

[Abstract] Consecutive learning procedures of image recognition are examined. Guarantees of quality and reliability of recognizing new objects by applying the decision criterion obtained during the learning process and capacity of operating with different types of objects constitute the fundamental requirements to the methods of learning image recognition. The decision criterion must be readily interpreted and technically simple to implement when designing specialized recognition devices. In addition, limitations are frequently imposed on the operation time of the learning algorithms, and on the volume of the on-line memory needed during the learning process. The examined learning procedures are oriented on operation with objects with binary properties. However, the initial properties of objects can be measured in a continuous scale or in a scale which is weaker than the continuous scale. References 4 Russian.

#### **Application of Artificial Intelligence in Network Operating Systems**

937K0098A Riga AVTOMATIKA I  
VYCHISLITELNAYA TEKHNIKA in Russian No 5,  
Sep-Oct 92 pp 3-9

[Article by V. V. Pirogov, P. A. Grishanov, S. M. Olevskiy, T. V. Fedoseyeva; UDC 681.3]

[Abstract] Applications of artificial intelligence (AI) methods for increasing the efficiency of network operating systems (NOS) and the current status in development of expert systems and related technologies are reviewed. It is pointed out that methods of specification and compilation of knowledge, and the intelligence systems for knowledge acquisition are prominent among the contemporary methods in the development of complex expert systems. Developing a system to control the knowledge-base (SCKB) is one possible ways for solving the problem of effective storage and handling of large volumes of knowledge and facts. The existing systems employing SCKB in the NOS are cited. Distributed artificial intelligence (DAI) belongs to a special area of the AI. Examples of its application are also cited. Evolution of a specialized PLUS NOS from a regular non-intelligent system, which was developed with the participation of the authors of this article, to an intelligent system and its functioning is discussed. The PLUS system is based on a centralized storage of all information needed to organize interaction of the applied processes (AP) in a distributed computing medium (NetWare), and on a controlled interaction of the AP by any computer. A prototype model of an intelligent PLUS has been developed. A block diagram of the architecture of its main component - the monitor of interaction system, and the PLUS functioning diagrams are provided. Figures 2, references 18: 6 Russian, 12 Western.

#### **Uses of Elliptic Curves in Cryptography**

937K0098B Riga AVTOMATIKA I  
VYCHISLITELNAYA TEKHNIKA in Russian No 5,  
Sep-Oct 92 pp 23-32

[Article by O. V. Kazarin, L. M. Ukhlinov; UDC 631.324]

[Abstract] The feasibility of using the properties of elliptic curves for construction of cryptographic protocols is discussed. In order to help explaining the principal conclusions and reasoning, definitions are introduced from algebra, the theory of numbers, and contemporary cryptology. The elliptical curves theory applicable to cryptology and the properties of the elliptic curves needed to construct the crypto-systems is examined. Several cryptographic schemes are proposed, which include two coding-decoding schemes, and an authentication scheme. A short analysis is made of the immunity of the proposed schemes. The authors objective was not to carry out a comprehensive analysis of the above schemes, but to point out a possible approach to designing crypto-systems and crypto-protocols by applying the techniques of the elliptic curves. Preliminary computations indicate that development of the crypto-systems based on properties of the elliptic curves will result in providing a sufficiently high level of speed, compared to other crypto-systems, without reducing the immunity of the crypto-algorithms. Figure 1, table 1, references 12: 3 Russian, 9 Western.

### Performance of the X.25 Channel With a Fixed Source of Errors at a Different Rate of One-Way Transmission of Digital Information

937K0098C Riga AVTOMATIKA I  
VYCHISLITELNAYA TEKHNIKA in Russian No 5,  
Sep-Oct 92 pp 33-44

[Article by A. N. Sklyarevich; UDC 681.324]

[Abstract] In the contemporary data transmission channels the rate of transmission can be varied. This rate determines the quality of service. Its characteristic at a different transmission rate, but with a specified type of transmitted information, network load, parameters of network facilities and the source of errors are examined. A one-way transmission of large data bulk at possible rates of  $w=1200, 2400, 4800, 9600$  bit/sec is analyzed. At this rate, the most important quality index of the service performance is the virtual time (VT) of a frame transmission with a full data package. If the VT is known, other indicators of performance can be determined. Effects of internal and external sources of errors are examined. The external source of errors is caused by atmospheric and thermal fluctuations of signals, lighting and industrial discharges, etc. Three groups of the error sources and the corresponding models are discussed. Examples are provided for computations of the VT of a data frame transmission by applying different models. The most important are the Markov models with separation of the conditions into "good" or "bad". A small intensity of generation of a bit-error corresponds to the good condition, the intensity which corresponds to the bad condition is so large that the data frame is transmitted with an error. The X.25 channel provides for repeated transmission of the data frame which was transmitted with an error. Figures 4, tables 2, references 4 Russian.

### Resonant Noise in Power Supply Circuits of Ultrahigh-Speed Digital ICs and Methods of Suppressing Them

937K0074A Moscow MIKROELEKTRONIKA in  
Russian Vol 21 No 5, Sep-Oct 92 pp 3-10

[Article by Yu.F. Adamov, L.N. Kravchenko, A.I. Khlybov, Scientific Research Institute of Molecular Electronics; UDC 621.382]

[Abstract] The emergence of GaAs integrated circuits whose speed exceeds that of emitter-coupled logic (ESL) circuits by threefold greatly complicates the problem of noise immunity and renders existing suppression methods inadequate for digital GaAs ICs (IMS), especially at resonant frequencies. This prompted an investigation into the nature of resonant noise in power supply circuits of ultrahigh-speed digital ICs and an examination of possible methods of suppressing them. To this end, the phenomenon of pulse noise resonance and its relationship with the superhigh-speed IC design, the issue of ensuring digital IC resonant noise immunity at the design stage, the procedure of rejecting ICs with

low noise immunity during the design stage, and the facilities for ensuring the noise immunity of these ICs during the operation of equipment are considered in detail. The study shows that digital IC errors appear when the power supply circuit noise pulses are in sync with the input pulses. Recommendations are made for ensuring IC performance: the principal requirement is to select a noise immune design and high-frequency packaging and use separate power supply inputs regardless of their voltage. In addition, IC testing must approximate real operating conditions. Figures 5; references 6: 3 Russian, 3 Western.

### Electric Characteristics and Logic Abilities of Source Coupled Paraphase Logic Schottky Barrier GaAs FET Elements

937K0074B Moscow MIKROELEKTRONIKA in  
Russian Vol 21 No 5, Sep-Oct 92 pp 11-19

[Article by S.S. Pripistsov, I.I. Shagurin, Moscow Engineering Physics Institute; UDC 621.382]

[Abstract] The principal electric characteristics and logic abilities of source coupled logic devices (ISL) with paraphase control (ISPL) are analyzed for GaAs Schottky barrier FET LSI circuit elements. To this end, the main electric characteristics of ISPL elements are studied and transfer functions of the normally on and normally off Schottky barrier FETs simulated with and without regard to the drain resistance and current are plotted; the switching band width is determined on this basis and the switching delays of ISPL logic elements are summarized. The logic abilities of the single-layer ISPL elements are assessed and the logic functions performed by two-layer ISPL logic elements are summarized. Due to a decrease in the utilization frequency of logic functions in digital devices with an increase in the function complexity, it is expedient to use two-layer IC elements as the base ISPL elements. Figures 4; tables 2; references 9: 3 Russian, 6 Western.

### Metallization From Al + 17% Mn Amorphous Alloys

937K0074C Moscow MIKROELEKTRONIKA in  
Russian Vol 21 No 5, Sep-Oct 92 pp 20-31

[Article by Ye.E. Glikman, A.I. Ilin, V.E. Pinneker, L.G. Shabelnikov, Ye.M. Sokolova, V. Demin, N.M. Stepanova, Institute of Microelectronic and Especially Pure Metal Technology Problems at Russia's Academy of Sciences; UDC 621.382]

[Abstract] Semiconductor device failures due to electrodegradation (ED) and diffusive relaxation in IC metallization and the lack of published data on the resistance of Al-Mn alloy films to electrodegradation and electromigration (EM) and the scarcity of systematic studies of the electric conductivity and corrosion resistance of amorphous alloys in various phase and structure states prompted an attempt to deposit amorphous bonding

films from an alloy of Al and 17% Mn by the RF magnetron method widely used in microelectronics and to examine their properties from the viewpoint of metallization reliability. The Al + 15% Mn alloy is selected due to its elevated propensity to amorphization. The films are deposited onto a cold SiO<sub>2</sub> substrate and their crystallographic structure and phase composition are examined by transmitted and reflected electron diffraction analyses and thin film X-Ray diffractometry with grazing beam incidence. The dependence of the film resistivity on its temperature, the behavior of resistivity during isothermal annealing and during electromigration tests, the behavior of relative Mn concentration along the conducting track after a current pulse, and the number of annealing bumps per unit of film area as a function of annealing temperature are plotted. An analysis shows that in addition to the crystal phase, the film contain an amorphous or ultradisperse crystalline phase; the conducting tracks made from this metallization have a high ED resistance in an electric field while the films have an exceptionally high corrosion resistance after annealing. The films are a promising material for making reliable contacts operating at a temperature of 500-700 K. The authors are grateful to Z.I. Brantova and A.I. Priymak for help with research. Figures 9; tables 1; references 19: 8 Russian, 11 Western.

#### **Application Characteristics of Self-Testing Method in Digital Device System Design**

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in Russian Vol 21 No 5, Sep-Oct 92 pp 32-36

[Article by M.M. Tatur, Minsk Military Engineering Academy; UDC 621.382]

[Abstract] The principle of structural support of self-testing for checking the operation of a combined device is outlined and the need to take into account local control automata (UA) in self-testing design and address the issue of efficient testing control function allocation among local control automata and external or systems control automata is stressed. The structural model of the diagnosed entity is clarified and the testing procedure based on using the decomposition principle which provides for off-line checking of individual units and assemblies and the connections between them is examined. The built-in logic block observer method is employed in ensuring the digital device self-testing for both operational and control automata. The hardware modifications of the self-testing method are considered and the operating conditions of the all-purpose register with the corresponding codes and the operating conditions of the principal device function and its self-testing procedure are summarized. The sequence of self-testing procedures is described. The conclusion is drawn that self-testing facilities can be used successfully for fault location in both operational and control automata and that hardware outlays for realizing self-testing do not differ significantly from known methods. The proposed procedure can be used in real time. Figures 4; tables 2; references 4.

#### **Certain Aspects of Determining Yield of Fault Tolerant Circuits on Chip**

937K0074E Moscow MIKROELEKTRONIKA  
in Russian Vol 21 No 5, Sep-Oct 92 pp 37-44

[Article by V.A. Golovko, Engineering Cybernetics Institute at the Brest Department of the Belarussian Academy of Sciences; UDC 621.3.049.7]

[Abstract] V.A. Golovko's study of statistical models of fault tolerant circuit yield (*Mikroelektronika* Vol. 21 No. 1, 1992) is continued. The importance of assessing the yield of fault tolerant circuits at a chip or board integration level prompted an attempt to demonstrate the equivalence of the corresponding yield models produced by various techniques for different redundancy methods. It is shown that the statistical yield models for various redundancy methods are determined by the number of permitted circuit element combinations equal to the number of methods of selecting elements from among the total number of elements which do lead to a circuit failure. A method of analyzing the number of permitted combinations for sectioned redundancy is developed on the basis of the redundancy theorem proof. The method makes it possible to derive precise yield expressions for heterogeneous circuits with one or several defect sources on the chip using the generalized negative binomial distribution and Maxwell-Boltzmann or Bose-Einstein correlations. The equivalence of various statistical models is examined. The findings are suitable for designing fault tolerant circuits with a chip-level integration. Figures 1; references 4: 3 Russian, 1 Western.

#### **Low-Temperature Silicon Nitride: Promising Insulator for Semiconductor Technology**

937K0074F Moscow MIKROELEKTRONIKA  
in Russian Vol 21 No 5, Sep-Oct 92 pp 62-66

[Article by N.M. Rubtsov, S.S. Nagornyy, V.I. Rubtsov, Yu.M. Shulga, V.I. Zakharyin, Structural Macrokinecs Institute at Russia's Academy of Sciences; UDC 541.11:54-16+539.2]

[Abstract] Interest in low-temperature deposition of insulator films for subsequent use in new semiconductor technologies and the problem of low yield in multi-layer IC metallization prompted a study of certain properties of thin silicon nitride films deposited at room temperature in a high-frequency discharge in a commercial unit and an attempt to demonstrate that homogeneous strong SiN<sub>x</sub>H<sub>y</sub> films can be deposited on silicon substrates at 298 K in a 450 kHz RF 100 mW/cm<sup>2</sup> discharge from a mixture of SiH<sub>4</sub>, NH<sub>3</sub>, and N<sub>2</sub>. The details of the experiment carried out in a commercial reactor with horizontal wafers at a 10 cm spacing between the electrodes are outlined and the infrared spectrum of a silicon nitride film deposited at 293 K and typical volt-farad characteristics of the *n*-Si/SiN<sub>x</sub>H/Al structure are plotted. The maximum observed on the voltage-capacitance curves near the depletion area is discussed. The good mechanical properties, dielectric strength,



temperature stability, and plasticity of the films is noted and the silicon nitride film suitability for preventing defect formation in aluminum metallization and reducing leakage currents is confirmed. Figures 3; references 15: 3 Russian, 12 Western.

### **Fringe Effects and Magnetization Characteristics of Permalloy Microelectronic Elements**

937K0074G Moscow MIKROELEKTRONIKA  
in Russian Vol 21 No 5, Sep-Oct 92 pp 86-95

[Article by Ye.N. Ilicheva, Yu.N. Fedyunin, A.G. Shishkov, Moscow State University; UDC 621.382]

[Abstract] Increasing uses of permalloy elements in write-read magnetic heads (IMG) and magnetic bubble memory (TsMD-ZU) as well as other devices prompted an experimental investigation into the magnetization distribution near the poles of a vertical write-read head and an examination of the fringe effect in narrow thin film magnetoresistive memory elements characterized by a high response speed and reliability. The study is carried out with the help of a polarization magnetooptic unit employing Kerr's meridional effect with a micrometer resolution while the domain structure of the thin film elements was revealed using a magnetic suspension. The experimental procedure is outlined in detail and the dependence of magnetooptic signal on the distance to the permalloy element fringe in a low-frequency magnetic field, the dependence of the fringe zone width on the magnetic field strength for elements with various thickness, and the local magnetization curves are plotted. The findings show that as the thin film elements are magnetized, the magnetization zone gradually turns around with a several micrometer-wide zone whose width is proportionate to the ferromagnetic layer thickness and inversely proportionate to the field strength. The edge zone decreases the operating efficiency of the head poles due to the magnetic flux shunting. The need to take magnetic anisotropy into account is stressed. Figures 7; references 15: 7 Russian, 8 Western.

### **Assessment of Certain Characteristics of Tomography Study of Microobjects in Synchrotron Radiation Beams**

937K0073A Moscow MIKROELEKTRONIKA  
in Russian Vol 21 No 6, Nov-Dec 92 pp 3-7

[Article by L.G. Velikanova, Scientific Research Institute of Physical Problems imeni F.V. Lukin; UDC 621.382]

[Abstract] Extensive implementation of synchronous radiation sources (SI) in computer-aided tomography necessitated an analysis of the peculiar features of one of the simplest models of these practices developed by L. Grodzins and attempts to improve it and make tentative estimates for the specific synchrotron radiation source in Zelenograd. Computer-aided tomography does not call

for using references and standards and is a nondestructive inspection method which makes it possible to derive information about the layer-by-layer impurity and defect distribution in a microscopic object. The issue of optimum selection of the transmission radiation photon energy for a specified object diameter is addressed. The estimate derived on the basis of the CAT model make it possible a priori to establish for each specific system the optimum scanning energy and the resulting spatial resolution; by manipulating the CAT experiment parameters and the degree of synchrotron radiation monochromaticity, one can improve the spatial resolution or increase the proportion of the impurity under study. It is noted that only numerical statistical simulation without stringent assumptions is capable of increasing the confidence of a priori studies. The author is grateful to Prof. N.G. Preobrazhenskiy for attention and advice. Figures 1; tables 1; references 7: 2 Russian, 5 Western.

### **Photochemical Oxidation of GaAs Surface in Oxygen**

937K0073B Moscow MIKROELEKTRONIKA  
in Russian Vol 21 No 6, Nov-Dec 92 pp 22-26

[Article by I.A. Ayzenberg, L.I. Aparshina, Institute of Microelectronic and Especially Pure Material Technology Problems at Russia's Academy of Sciences; UDC 621.79.02:66.085.3]

[Abstract] Interest in native GaAs oxide films serving as protective layers in molecular beam epitaxy (MLE) or insulators in MIS (MDP) structures and the relative difficulties of chemical and thermal GaAs oxidation methods prompted an investigation into the process of photochemical oxidation of the GaAs surface in oxygen or ozone. To this end, degreased (100) GaAs wafers are oxidized in a horizontal planar reactor in an oxygen flow at an atmospheric pressure. Xenon and krypton lamps are used as ultraviolet radiation sources. The radiation absorption degree in the oxygen layer over the wafer was controlled by changing the gap between the sample and the optical window while the samples were heated by infrared lamps. Ellipsometry, X-ray photoelectron, and Auger electron spectroscopy are used to examine the photochemical and thermal oxidation kinetics and the chemical composition of the film and the surface. A noticeable rate of photochemical GaAs oxidation in O<sub>2</sub> was observed under ultraviolet radiation within a 124-147 nm band at 30° C; at this temperature, carbon contamination is effectively removed from the surface under the effect of atomic oxygen particles forming during the photolysis. The elementary As accumulation observed on the GaAs interface with the native oxide is determined only by the process temperature rather than the oxidation rate. The photochemical oxidation process largely occurs by oxygen diffusion through the growing oxide film with subsequent GaAs oxidation on the interface with the oxide. Figures 4; references 13: 7 Russian, 6 Western.



**Investigation of Transient Processes in ECL Elements With Submicrometer Polysilicon Transistor Structures Using Adequate Device Circuit Simulation**

937K0073C Moscow MIKROELEKTRONIKA  
in Russian Vol 21 No 6, Nov-Dec 92 pp 40-52

[Article by A.N. Bubennikov, A.V. Chernyayev, Cybernetics Problems Institute at Russia's Academy of Sciences; UDC 621.382]

[Abstract] The rapid development of microtechnologies and integrated circuit technology of bipolar silicon superhigh-speed VLSI (S<sup>3</sup>BIS) and CMOS (KMOP) circuit designs and the availability of VLSI CAD (SAPR) systems making it possible to utilize mixed device circuit simulation methods (PSM) prompted a study of the transient processes in current switches and ECL (ESL) VLSI elements with submicrometer-thin transistor structures (TS) for various impurity distribution profiles in the collector-base area and under various electric conditions, and a comparison of the outcome of device circuit simulation and circuit designs developed with the help of electric transistor structure models. A device circuit model of an IC fragment utilizing the STRAN2 program and ECL element transient process simulation with the help of a mixed device circuit simulation (PSM) model are considered in detail. The transients are calculated using an IBM PC AT/386; the CPU time is 40-50 min for one transistor structure. For comparison, a supercomputer takes only one minute to perform the same analysis. The electrophysical switching processes (transients) in the transistor current switch structure is analyzed with the help of the STRAN2 program and the transient analyses of current switches performed with the help of STRAN2 and SPICE2 programs are compared. The results confirm the need to use device circuit simulation for adequately describing the behavior of today's and prospective VLSI transistor structures and synthesizing and tuning compact electric models of transistors for circuit designs of VLSI fragments in the corresponding CAD systems. Figures 7; references 12: 9 Russian, 3 Western.

**Integrated Circuit GaAs Driver of RF Pulses With Improved Characteristics for Testing Systems and Fiber Optic Communication Lines**

937K0073D Moscow MIKROELEKTRONIKA  
in Russian Vol 21 No 6, Nov-Dec 92 pp 53-57

[Article by Yu.F. Adamov, L.N. Kravchenko, A.I. Khlybov, Scientific Research Institute of Molecular Electronics; UDC 621.382.8]

[Abstract] The principal data on a new IC of an RF driver with improved characteristics are considered and the design which made it possible to attain these improvements is examined. A block diagram of the new RF pulse driver and an electric circuit diagram of the RF pulse driver IC are cited. Existing drivers developed by Triquint Semiconductor and ATT's Bell Laboratories are summarized and their characteristics are compared to those of the new device. The new design is superior to

known drivers and is characterized by the following specifications: a leading pulse duration of 15 ns, an output pulse amplitude of 0.5-1.5V, a signal bias control range of up to 2.5 V, a signal propagation delay of no more than 0.45 ns, a pulse repetition frequency of up to 1,500 MHz, and a transfer function hysteresis of no more than 5 mV. It is shown that the proposed IC driver design is the only source of pulse signals with suitable characteristics for instrumentation and transmission units of digital communication systems. Figures 2; references: 4 Western.

**Computer Simulation of Memory Reading Unit Based on Ion Implanted Propagation Patterns**

937K0073E Moscow MIKROELEKTRONIKA  
in Russian Vol 21 No 6, Nov-Dec 92 pp 66-74

[Article by V.I. Beresnev, A.B. Zyblev, G.A. Shmatov, Physics of Metals Institute at the Urals Department of Russia's Academy of Sciences; UDC 621.382]

[Abstract] The principles of data reading in bubble (TsMD) memory (ZU) on the basis of the magnetoresistive phenomenon and the design of a thin-film magnetoresistive sensor (TMD) used for this purpose as well as the mechanism of bubble stretching in ion implanted propagation pattern (IISP) memory with the help of special current busses are discussed. A model is formulated in order to analyze certain dynamic characteristics of the bubble stretching into a stripe domain under the effect of the current pulses in conductors and some design parameters of the read unit are optimized in order to maximize the signal. A schematic diagram of the read unit is cited and the dependence of the stability area of the rectangular domain on the width of the nonimplanted film segment in which the bubble is stretched, the dependence of the minimum stretching current on the width of the stretching area and the half-distance between the current busses, and the dependence of the sensor signal on the distance between the sensor and stripe domain centers and on the distance between the sensor and the bubble film are plotted. The output current of the thin film magnetoresistive sensor is calculated and the existence of an optimum sensor position is demonstrated. The computer simulation makes it possible to analyze the shape of the output signal during the control field rotation. Figures 6; references 9: 4 Russian, 5 Western.

**Mixed Microcomputer Device Circuit Simulation System for Two-Dimensional Semiconductor Structures**

937K0073F Moscow MIKROELEKTRONIKA  
in Russian Vol 21 No 6, Nov-Dec 92 pp 75-85

[Article by N.I. Filatov, B.O. Nakropin, D.G. Yakovlev, Russia's Institute of Information Systems; UDC 621.382.2]

[Abstract] The use of computer simulation in semiconductor and IC design and the savings resulting from the substitution of expensive experiments with fast calculations are discussed and it is noted that thus far, such analyses have usually been performed on supercomputers. A new PC-oriented ISTOK-2D mixed device circuit simulation system for LSI circuits which, in contrast to traditional programs, is based on physical and topological LSI circuit models is described. Transient processes in an inverter made on the basis of 2  $\mu\text{m}$  BiCMOS technology are analyzed for illustration. The ISTOK-2D system is versatile in that it makes it possible to simulate silicon IC structures with metal, insulator, semiconductor, and polysilicon areas with a random geometric shape in a random combination with an arbitrary circuit arrangement. The high prediction accuracy of the model is due to the use of a fundamental system of semiconductor equations in a two-dimensional approximation as the physical model of IC elements. Implementation of the ISTOK-2D system using PCs and the user-friendly interface as well as other features make the system a powerful tool in the hands of semiconductor device and IC designers. Figures 6; references 19: 7 Russian, 12 Western.

### Electronic Communications and the Economy: and Information-Economics Law

937K0137A Moscow ELEKTROSVYAZ in Russian  
No 12, Dec 92 (manuscript received 20 May 92) pp 2-6

[Article by L. Ye. Varakin; UDC 621.39:338]

[Abstract] It has been known for years that there is a certain relation between the level of the economy and the level of development of communications. However, until now there has been no exact analytical description of this relation, though it is of great practical importance. It can be used to determine the technical level of communication corresponding to the economic level of development of a country, and the amount which needs to be invested in communication. The interrelation between the gross national product and the volume of information created by a society in the process of producing the GNP was studied. An information-economic law was found establishing a link between the GNP and the volume of information produced. The proof of the existence of this law is presented. Figures 7; references 14: 5 Russian, 9 Western.

### Soliton Fiber Optic Transmission Systems

937K0137B Moscow ELEKTROSVYAZ in Russian  
No 12, Dec 92 (manuscript received 8 Apr 91) pp 14-17

[Article by G. I. Gordon, Ye. A. Zarkevich, P. A. Mishnayeyskiy, P. P. Ovvyayn, and V. I. Smirnov; UDC 621.7.068]

[Abstract] The development of long-distance fiber optic transmission systems has been hindered by high dispersion levels in one-mode optical fibers. Although great strides have been made in reducing dispersion, it is still a problem. A new solution is the use of optical solitons,

that is, single optical pulses of a given shape which induce self-modulation of phase in propagation through the fiber. This leads to compensation of the negative dispersion of the one-mode optical fiber. It is now possible in principle to transmit optical signals over great distances without distortion. This article evaluates various fiber optic transmission systems and performs structural analysis of the systems. A method of calculating the parameters of a one-mode optical fiber in a soliton fiber optic transmission system is presented. The parameters of Raman amplification in a one-mode optical fiber are calculated. Figures 4; references 15: 3 Russian, 12 Western.

### Methods of Reducing the Downtime of Fiber Optic Transmission Systems

937K0137C Moscow ELEKTROSVYAZ in Russian  
No 12, Dec 92 (manuscript received 20 Dec 91) pp 22-23

[Article by R. I. Levitan; UDC 621.372.8:535.019.3]

[Abstract] The character of fiber optic transmission systems leads to operational difficulties. The relatively short life span of a laser, and the long time required to repair optical cable leads to losses due to downtime. One way of reducing downtime is the effective organization of repair. Laser breakdowns are responsible for about 85 percent of all failures in fiber optic transmission systems. Degradation of the output power of the laser diode occurs gradually (according to an exponential law). This gradual degradation and priorities in the execution of repairs are considered in the model. The failure time of a laser can be approximately predicted from the service time of the equipment. Queueing theory was used in the development of the model. A table of repair strategies with their corresponding mathematical expressions is presented. A method is developed which makes it possible to determine the optimal strategy for the repair of a fiber optic transmission system. Recommendations are presented to increase the operational reliability of the system. The reliability of a system consisting of low-reliability elements can be increased by effective organization of system service. Table 1; references 4: 3 Russian, 1 Western.

### Economic Feasibility of Creating an Integrated Digital Synchronous Network To Transmit Discrete Information

937K0137D Moscow ELEKTROSVYAZ in Russian  
No 12, Dec 92 (manuscript received 21 Feb 90) pp 32-34

[Article by S. M. Kuleshov; UDC 654.004.015]

[Abstract] This article presents a method of determining the economic feasibility of creating a digital synchronous data network for discrete information transmission and the basic points used to compare a digital synchronous data network and a digital switching network. Examples

are presented. The expenses for the transmission of a unit of information and the average annual cost are compared for various systems. Both expenses should be minimized. The conditions for economic feasibility are determined on the basis of these and other factors. The mathematical expressions used are presented. Practical examples are given. It is found that it is economically expedient to develop a digital synchronous data network. It is even more desirable if one considers that this type of network can be constructed on a shorter time scale than an integrated digital switching network. Moreover, a digital synchronous data network also meets the needs of telegraphic services, so one can avoid expenses for the maintenance, modernization and further development of networks which currently provide these services. Figures 2; table 1; references 5 (Russian).

**PCM-480-5 Equipment for a Tertiary Digital Optical Transmission System for City Telephone Networks**

937K0134A Moscow ELEKTROSVYAZ in Russian No 11, Nov 92 pp 1-4

[Article by Ye. B. Alekseyev, M. I. Aleksandrovskiy, A. M. Gofman, Yu. V. Sverkal'tsev; UDC 621.373.826:621.39]

[Abstract] Pulse Code Modulation System PCM-480-5 has been developed and based on the results of state tests a decision was made to start a mass production of this equipment at the Perm factory of the communication apparatuses in 1993. It was also decided that testing and design works should be carried out by the Central Communications Scientific Research Institute and the Scientific Research Institute for Digital Information Transmission Systems "Takt" of the PCM-480-M apparatuses with the objective to develop a linear channel equipment in the 1.55 micrometer wavelength, and to develop a uniform equipment for tertiary group formation. With this equipment, in order to reduce the group forming equipment, it will be possible to combine into the tertiary digital 34.368 Mbit/sec flow both the secondary 8.448 Mbit/sec flow, and the primary 2.048 Mbit/sec flow as well. The PCM-480-M belongs to the second generation of fiber-optic communication transmission system and is fully compatible in terms of design and engineering servicing with the fourth generation digital communication systems PCM-30-4, PCM-120-4 and the PCM-120-5 system. Technical specifications of the PCM-480-5 system are provided and its operation algorithm is described. Figures 3, references 2 Russian.

**Computation of Noise Immunity of Soliton Fiber-Optic Transmission Systems**

937K0134B Moscow ELEKTROSVYAZ in Russian No 11, Nov 92 pp 9-10

[Article by P. P. Ovvyan, V. I. Smirnov; UDC 681.324]

[Abstract] At a specified reliability, dispersion in optical fibers (OF) limits the transmission rate and the length of regeneration sections of fiber-optic transmission systems (FOTS). A significant improvement of these characteristics can be achieved by employing the effects of nonlinearity. Under certain conditions a simultaneous manifestation of nonlinearity and dispersion allows to form pulses with an envelope which preserves its shape while propagating in the fiber. These pulses are called solitons, and the transmission systems are called soliton FOTS. The fundamental characteristics of fiber-optic transmission systems (FOTS) are estimated in this article. This includes noise immunity and transmission rate of the soliton FOTS, taking into account the particular features of the solitons propagation along the optical fibers. Expressions are obtained which allow to compute the energy losses of soliton FOTS of specified length. It is demonstrated that at a specified noise immunity, the transmission rate must be selected for known characteristics of the fibers and the solitons. For a 1,000 km line, the error probability  $10^{-9}$  and dispersion  $10 \text{ ns}^2/\text{km}$  at the soliton duration of 2...8 ns, the transmission rates lie within 38...12.5 Gbit/s. Figure 1, table 1, references 4: 3 Russian, 1 Western.

**DKD-400 Coder-Decoder of Adaptive Differential Pulse Code Modulation Equipment for Digital Satellite Communication**

937K0134C Moscow ELEKTROSVYAZ in Russian No 11, Nov 92 pp 24-26

[Article by A. V. Minin, S. N. Deryugin; UDC 621.396.9]

[Abstract] Results of development and experimental studies of adaptive differential pulse code modulated (ADPCM) codec, designed in accordance with the CCITT Recommendation G.721 for digital satellite communication equipment DKD-400 are described. The codec with echo rejection elements was constructed based on the Russian analog of familiar foreign digital signal processor TMS 320 C10. The ADPCM codec constitutes a most successful compromise between the complexity of engineering construction, the rate of transmission and quality of voice reproduction at the system output. It was demonstrated that it is feasible to construct the ADPCM algorithm with a domestic element base. Qualitative indicators of the synthesized codec point out that it can be employed with subscribers and mainline communication channels. Figures 4, tables 3, references 5: 4 Russian, 1 Western.

**Tolerable Mismatch of Input Devices at Satellite Communication and Broadcasting Stations**

937K0134D Moscow ELEKTROSVYAZ in Russian No 11, Nov 92 pp 26-28

[Article by B. A. Lokshin, V. M. Tsirlin; UDC 621.396.946:621.396.621.2]

[Abstract] An analysis was made of operation of a ground station for satellite communication and TV broadcasting when employing mismatched input devices. It was demonstrated that the mode of the ground station operation with matched or mismatched input devices are characterized by some reduction of transmission, however, the values of losses and the character of its manifestation are different. Therefore, when designing ground stations, a type of the input device must be selected which in the best way satisfies the requirements. A table is provided for comparison, showing the advantages and shortcomings of solutions when employing matched or mismatched input devices. Using these data a proper selection can be made for each individual situation. Figures 4, table 1, references 2 Russian.

### Radio Relay Channel in the 7.9...8.4 GHz Range

937K0134E Moscow ELEKTROSVYAZ in Russian No 11, Nov 92 pp 32-36

[Article by A. A. Metrikin, V. V. Malin; UDC 621.396.677.83]

[Abstract] A new antenna-feeder system "Shpora-8" is described. No scarcely available materials are required for the construction of this system, no bulky foundation is needed, and the construction time is reduced down to several days. The system consists of a tower made of aluminum alloy tubes which also perform the waveguide functions for signal transmission and reception. The antenna and the waveguide are described and their diagrams are provided. Experimental studies were conducted under laboratory conditions to determine the effect of multiwave features on the channel's parameters. Theoretical analysis of the channel's standing wave ratio was performed. The parameters of the tower make it possible to organize up to 300 telephone channels exhibiting a good quality. Figures 8, tables, references 5: 4 Russian, 1 Western.

### Only Hard Currency Buys Reliable Communications

937K0018A Moscow KOMMERSANT in Russian No 4, 1 Feb 93 p 29

[Article by Kirill Maslentsin: "Only Hard Currency Buys Reliable Communications"]

[Text] If you intend to call Paris or perhaps New York this week, remember that international communication services are going up an average of fourfold on Tuesday (the weekly KOMMERSANT warned its readers about the forthcoming increase already in the last issue). The price increase will hardly reduce demand for international communication services. And so it will be just as difficult as before to reach a foreign partner by telephone during the day; the system of advance booking continues.

Meanwhile there are both state and alternative communication lines which allow working under conditions convenient for the client and which offer higher quality services in the process. Commercial structures began to fill this niche a year and a half to two years ago and now are not only satisfying the demand rather promptly, but are even beginning to compete among themselves. The Russian-American Sovintel SP [joint venture], for example, intends to set new hard currency rates for its services this week which, according to company representatives, will reduce rates by an order of magnitude.

Last week KOMMERSANT conducted a small poll of various Moscow firms in an attempt to determine what international communication channels are the most popular among them. As it turned out, Russian firms prefer the so-called "category 0" lines which allow organizing such communication for rubles.

The foreign firms, however, which must pay for category 0 services with hard currency, prefer the more expensive, but then higher quality, communication. This includes the service installed last week in the new, five-star Palace Hotel (its official opening will be 1 February). The hotel management selected the Komstar joint venture network which allows practically instantaneous connection to subscribers abroad.

Naturally, the selection of communication channels depends both on the requirement for higher quality communication and on financial capabilities. However, in the process, it is worth keeping in mind that in future ruble rates for international communications will, in all likelihood, increase while the hard-currency rates are gradually decreasing with the growth in competition.

**Category 0.** The "zero" is not a separate communication channel; this is a special status for a subscriber to the ordinary Moscow municipal telephone network which provides the capability of calling abroad by dialing direct at any time of the day.

As Boris Zverev, deputy chief of the Moscow Long-Distance and International Telephone State Enterprise (GP MMT), explained, there is no limit on the number of telephones in this category; that is, practically every subscriber on the municipal network can obtain it. The only reason for being possibly turned down is the lack of technical capability for connection (of such ATS [automatic telephone exchanges] in Moscow 24).

However, those with category 0 lines run into the same problems as the ordinary subscribers. Mikhail Alekseyev, an expert with the Teleconsalt-Moscow firm, gave us his personal impressions from more than seven years of experience in using category 0 lines. According to his observations, the main problem with category 0 is the load on the long-distance switch, the "8" familiar to all of us. Because of this, the system does not work during peak business hours. In the morning, from 7 to 8:30, one can get through on the telephone rather quickly, but at that time any subscriber on the capital telephone network can also dial abroad direct, and then already at



11:30, the category 0 advantages fade away. The most difficult time is from 16:30 to 19:00. On Friday, for example, it took Mikhail Alekseyev 45 minutes to get through to London with the help of the "0".

In addition, category 0 has no advantage for incoming foreign calls; it is just as difficult with this line as with an ordinary telephone.

In all fairness, it should be noted that Russian firms pay for category 0 services in rubles and they are relatively inexpensive for the time being. And, in the absence of any possibility of organizing 24-hour direct-dial communication abroad by using the relatively inexpensive state channels, the "0" will remain popular for a rather long time yet. On some days, dozens of applications come into the municipal ATS [automatic telephone exchanges] from those wanting to have telephones in this category.

Foreign residents, representatives and firms pay for all services with hard currency. The Komstar joint venture takes care of registering and serving them.

**Kombellga and Sovintel Joint Ventures.** Kombellga provides international communication through satellite channels by using its own network which is not connected to the state network. Major subscribers, for example, hotels, are connected to the network by radio relay channels, and individuals, by direct lines leased at the Moscow Municipal Telephone Network association. According to client comments, Kombellga provides high quality and practically instantaneous communication. Operating similarly is the Sovintel SP [joint venture] which serves the Savoy and Metropol hotels and leases satellite communication channels. Both enterprises have international code registered at the International Telecommunication Union which allows organizing two-way communication.

**Komstar Joint Venture.** Komstar is setting up its own digital network by providing communication on international lines through the world-renowned British Telecom. From a Komstar telephone, one can call Moscow, any city in Russia and the world. The telephones in this network have the seven-digit numbers customary in Moscow and can be distinguished only by the beginning numbers (956-...).

As reported to the SP [joint venture], the enterprise now serves a little more than 1,000 subscribers. When it is necessary to telephone abroad, there is a choice: one can, after dialing "8," use the state channels, access to which is open 24-hours for Komstar subscribers, or one can dial a special code and use the higher quality but also more expensive satellite channels. Payment in both cases is made in hard currency. The foreign partner also has a choice; he can use the common country (7-095) or the Komstar code (7-503).

In the process, if you already have a category 0 telephone, then switching to the Komstar network number is free. But if you have an ordinary municipal telephone,

then a Komstar number along with category 0 will cost \$750. Installation of a new number will cost the client \$1,300.

**Iskra-2.** ASVT, a small enterprise, operates the Iskra. This network was opened for commercial use in 1991; up to then, it served party and state structures in Moscow and 425 cities in the former USSR.

Iskra-2 is separate from the conventional municipal network and confidentiality of conversations can be provided if a subscriber desires. According to Russian subscriber comments, Iskra-2 allows providing quality communication which is especially important to firms that have to transmit data or exchange facsimile communications in large quantity in Moscow and within the country. This network received access to international communication channels in February of last year and thus far direct dial to international channels is open only to its Moscow subscribers. This communication is provided through category 0 lines, but in the process Iskra is connected directly to an international station and therefore its subscribers do not experience problems with dialing the hapless "8"—a very valuable advantage. Payment is made in rubles.

By the way, a client on this network can also use the Sovintel satellite communication when desired, but in this case the Sovintel hard currency rate (including installation and subscriber fees) is extended to him.

Finally, the mobile radio telephone communication networks operating in Moscow also offer their clients international communication services. The AMT SP [joint venture], for example, provides access to foreign countries by using Sovintel, while the **Moscow Cellular Communications SP** [joint venture] (one of the founders of which is the Moscow Long-Distance and International Telephone State Enterprise) uses state channels. Both firms operate according to their own rates. A Moscow Cellular Communication users pays \$7 for one minute of international conversation (according to data from the American firm) irrespective of time of day or country.

Specialists note that state companies will be able to compete with active commercial firms next year already after new international stations will have been introduced in Moscow and Saint Petersburg.

Additional information is available by telephones in Moscow (095):

Komstar SP [Joint Venture]—979-16-92;

Kombellga SP [Joint Venture]—243-35-75;

Sovintel SP [Joint Venture]—215-60-97;

ASVT—299-73-56;

Moscow Municipal Telephone Network—299-28-85;



## International Telephone Communication Service Rates (for one minute)

Region	GP MMT Category 0		Iskra-2 Network Category 0	SP Sovintel (\$)			SP Kombelga (\$)**	SP Komstar (\$)
		Ruble Rate*	Hard Cur- rency Rate (\$)	Ruble Rate	Daytime Rate (from 0900 to 2300)		Nighttime Rate (from 2300 to 0900)	
		First Minute	Each Sub- sequent Minute	First Minute	Each Sub- sequent Minute			
Europe	110	1.50	135	3.75	3.38	2.81	2.53	2.50
Near East	150	2.00	184	5.25	4.73	3.94	3.53	3.50
North America	220	3.00	216	4.50	4.05	3.38	3.04	4.00
Central & South America	220	3.00	216	5.25	4.73	3.94	3.53	4.00
Southeast Asia, Japan	150	2.00	184	5.25	4.73	3.94	3.53	4.00
North Africa	150	2.00	184	5.25	4.73	3.94	3.53	4.00
Central & South Africa	220	3.00	216	5.25	4.73	3.94	3.53	4.00
Australia, New Zealand, Oceania	250	3.50	250	5.25	4.73	3.94	3.53	4.00

## Network Use Fee

Installation Fee	170,000 rubles	\$2,000	26,000 rubles	\$600			\$1,000 and 500,000 rubles	\$750-\$1300
Subscriber Fee (per year)	-	\$240	35,000 Rubles	\$324			\$240	\$250

\* - a system of "increasing" factors of 1.45 and 1.90 for the basic rate during peak hours is planned (see KOMMERSANT No 3, page 5, for details)

\*\* - 15 percent discount starting with the fourth minute

### From Optimal Information Processing to Optimal Knowledge Processing

937K0107A Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 92 pp 3-7

[Article by I. N. Troitskiy, I. S. Drovennikov, Ye. N. Petrova; UDC 621.391:007:19]

[Abstract] Using optimal information processing as a specific area of knowledge, the objective of this article is to illustrate the development dynamics of scientific ideas, and to help new engineers and scientists in the field of communication and radio-engineering to recognize the attractiveness of the thinking game in which they can participate. This article reflects a personal opinion of a professional in the field of radio engineering and can be interpreted as an attempt to comprehend some general problems directly concerned with this area of knowledge. Two positions of the contemporary scientific thought are discussed: the transition from optimal

information processing to optimal processing of knowledge, and from optimization to intelligence. Without dwelling much on the adaptive principles of optimal information processing, the author examines the recognition problem. The recognition is only one aspect of a more general problem - the problem of developing artificial intelligence, including the development of concepts and engineering facilities capable of imitating the process of human reasoning. Different methods are being developed now making it possible to collect knowledge, to describe it in an optimal form for computers and to teach it how to use it. Among these methods an important place is occupied by an approach which is based on the further development of the principles of optimal information processing. Efforts of the contemporary scientists are focused on the search of principles for optimal processing of already processed information. Further advances in the solution of fundamental problems of the information transfer and development of artificial intelligence significantly depend on their success. References 12: 4 Russian, 8 Western.

**Game Theory Synthesis of an Optimal, Linear Signal Filtering System**

937K0107B Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 92 pp 7-9

[Article by V. K. Marigodov; UDC 621.44:519.81]

[Abstract] Optimal linear signal filtering is synthesized based on the game theory approach. The designer of optimal linear signal filtering system can select the spectrum structure of the useful signal under conditions of a priority uncertainty and conflict. This can be achieved by applying optimal linear predistortion of the transmitted signal. A least rms can be realized by optimal linear signal filtering for gaussian signals, noise and the communication channels. Under these conditions, the optimal linear Kolmogorov-Wiener filters must have a complex frequency characteristic. This characteristic must be proportional to the complex conjugate spectrum of the received signal and inversely proportional to the noise spectrum. Since the designer of optimal linear filters doesn't necessarily know a priori the probability characteristics of the signal and noise, a conflicting situation can arise in interaction between the operator of the data transmitting system and the interference system. This situation occurs when the information transmitting system operates in the presence of countermeasures. Figures 2, references 4: 3 Russian, 1 Western.

**Asymptotic Invariant Algorithms for Signal Detection and Discrimination**

937K0107C Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 92 pp 9-12

[Article by V. A. Bogdanovich; UDC 621.396.96]

[Abstract] Algorithms for signal detection and discrimination with stable quality indicators under conditions of a priori uncertainty of interference situation are needed for designing automated systems of information transmission. Depending on the type of interference, different methods of statistical synthesis are used to develop such algorithms. In case of a combined action of diverse interference, a complex application of methods is needed. In this article a synthesis method of asymptotically optimal algorithms is described, which is based on the theory of combined detection and estimate of signals, invariance, and on the theory of asymptotic algorithms. The theory of combined detection and estimates is used for overcoming the uncertainty of the signal parameters. The methods of the invariance theory are used for dealing with the uncertainty of the additive noise parameters. The asymptotic approach makes it possible to carry out the solution of the synthesis problem to the realized algorithms, practically without limitations on the distribution type of the additive noise. References 10: 9 Russian, 1 Western.

**Optical Information-Carrying Systems With Distributed Multi-Purpose Filtering**

937K0107D Moscow ELEKTROSVYAZ in Russian,  
No 10, Oct 92 pp 22-24

[Article by A. M. Varfolomeyev; UDC 621.391.44:621.397.13]

[Abstract] Development of high efficiency optical information carrying systems (OICS) would greatly benefit the study of the World Oceans. This requires a synthesis of an optimal OICS which would provide for high-quality collection, processing and transmission of the video information under impact of various stochastic radiation on the optical and radio channels of these systems. To optimize the OICS in terms of range of detection and discrimination of objects in the light scattering media, a method of distributed multi-purpose adaptive filtering (DMPAF) was developed. Optimal OICS, invariant to complex electromagnetic conditions can be developed using this method. Interference protection of information transmitted by the communication channel under non steady-state conditions can be achieved by this method. This method also makes it possible to compensate distortion of video information caused by the scattering medium. A block diagram of the OICS with DMPAF, which implements the method for increasing the efficiency of the OICS in terms of the detection range in light-scattering media and curves showing the relationship of signal-to-noise ratio in the OICS as a function of the optical layer thickness are provided. Figures 2, references 8 Russian.

**Predicting the Electromagnetic Conditions in a Group of Mobile Communication Facilities**

937K0107E Moscow ELEKTROSVYAZ in Russian,  
No 10, Oct 92 pp 30-32

[Article by L. Sh. Alter; UDC 621.391.8]

[Abstract] Determination of the characteristics of interfering signals at a receiver input, that is evaluation of the electromagnetic situation (EMS) constitutes one of the problem of providing electromagnetic compatibility of radio devices and effective utilization of the radio spectrum. There is no data available for estimating the performance of receivers of large city mobile communication systems in a meter range. In this article, the characteristics of the EMS (mathematical expectation and dispersion of the interference field intensity) in the operating area of mobile service in large cities are determined for the 40 and 160 MHz range. The computed EMS parameters can be applied for the solution of many problems of providing the electromagnetic compatibility, as well as for predicting the quality of signal reception in the existing EMS and for standardizing the electromagnetic compatibility of receivers for maintaining the specified quality of signal reception. Figures 3, references 11: 10 Russian, 1 Western.

### Estimating the Requirements for Mobile Resources for Reconstruction of the Communication Network

937K0107F Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 92 pp 33-35

[Article by K. A. Meshkovskiy, A. Yu. Rokotyan; UDC 621.395.7]

[Abstract] Methods which are used to determine the required number and composition of systems needed for restoring disabled communications under emergency conditions are examined. An algorithm is developed for estimating the requirements by a statistical method. This method allows to estimate the likelihood of restoring the communication capacity with a selected number of communication facilities. The conditional likelihood of restoring individual network objects can also be estimated with this method. This information can be applied for locating the storage places and for selecting a strategy for a rational employment of resources for construction of permanent communication facilities. Figures 3, tables 2, references 5: 4 Russian, 1 Western.

### "Ekspokom-92": Business Means Partnership

937K0107G Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 92 pp 44-46

[Article by R. Levin]

[Abstract] The exhibit of telecommunication equipment "Ekspokom-92" was held in Russia again this year. Large companies from FRG, Italy, England, France and other European countries occupied half of the exhibition territory; the other half was divided between domestic enterprises and several American corporations, represented by their European branches. There were very few new exponents, but the mood of cooperation between East and West was well in evidence. The American AT&T company exhibited office telephone exchanges "Spirit", "Partner" and "Merlin Legend", and in addition to the familiar digital 5ESS exchange, demonstrated optical systems with a transmission rate of 140 and 565 Mbit/s, which were never shown before. To solve the "internal" telephone communication problem of the Commonwealth countries, German Phillips Kommunikations Industrie AG offered a digital communication system TSS, which was exhibited again this year. The association "Marafon" of the leading Russian companies in the area of satellite communication announced its existence at the exhibit. This association is developing a global system of satellite communication. According to its representative, the first 300 portable stations will be produced at the end of this year. The Sevastopol association "Musson" exhibited a new sample of a radio-buoy. Development of business activity and joint undertaking was the main topic of the exhibits of the American and most European companies.

### Optimal Synthesis of a Space-Time Signal Processing System Based on L-Problem of Moments

937K0094C Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 92 pp 13-15

[Article by S. V. Bukharin, I. L. Podkopayeva; UDC 621.391]

[Abstract] When phased antenna arrays of communication systems are synthesized, the problem of determining optimal vector of the weight factor under many linear limitations is very common. Normally, the squared quality index must be minimized under limitations requiring the linear functional to be equal to the specified values. A similar mathematical problem arises when performing a synthesis of multichannel communication systems, invariant with respect to the specified noise; multichannel amplifying paths with a minimal gain, etc. Normally, these problems are solved by the method of Lagrangian multipliers. A more effective method for a synthesis of a system for spatial and space-time signal processing, based on the solution of the L-problem of moments, is described in this article. The solution requires fewer computations and allows for more efficient use of the available a priori information. This method can be applied for the solution of other problems with linear limitations, specifically when minimizing the side-lobes of the antenna pattern of a phased array. Figures 2, references 5: 2 Russian, 3 Western.

### Adaptive Compensation of Structural Noise

937K0094D Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 92 pp 19-21

[Article by M. D. Venediktov, A. N. Stupin; UDC 621.372.55]

[Abstract] Adaptive noise compensation (ANC) is a method for optimal filtering. A low level of noise at the output and a small level of inserted signal distortions constitute the advantages of the method. The particular feature of this method lies in the necessity of copying the noise (reference signal). Normally, an additional radio receiving device is used for this purpose. An ANC device is described here, where the reference signal is obtained directly from the input combination of signal and noise. This article deals with reduction of the most harmful structural (signal-like) interference. The functional circuit of the ANC device is described and an analysis is made of its performance efficiency. A signal which coincides with the noise only in phase can be used in this ANC device as a reference signal. The AM noise is suppressed by an appropriate selection of the compensation unit (CU) parameters. At the ANC device output, the noise has three components: with a regular envelope, a noise envelope and a pseudo-random envelope. While the power of the first is decreased with increased transfer coefficient (gain) of the CU disconnected feedback loop, the powers of the second and the third are increased. A method is developed to determine the optimal value of

the transfer coefficient for which the noise power at the ANC device is minimal. Figures 2, references 5: 3 Russian, 2 Western.

### **An Automated Analyzer of the Decameter Communication Channel Quality**

937K0094E Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 92 pp 24-26

[Article by O. V. Golovin, V. Ye. Guzeyev, A. V. Korotov, N. Ye. Markov; UDC 621.391.83]

[Abstract] A block diagram of an automated analyzer of the communication channel quality in the decameter range is examined. Coded control and statistical prediction methods which are used with this analyzer for estimating the communication channel quality are discussed. These estimates have two important objectives: to determine the current value of accuracy of the received information and to detect the changing trends of the channel conditions, that is, its prediction. The principles of the analyzer functioning are described. A recurrent procedure of computing exponential average value is used for predicting the channel condition. This analyzer can be used with an automated adaptive radio communication system in the decameter range, as well as with the operating radio receiving stations for operational control of the received signal's quality. Figures 2, references 13: 12 Russian, 1 Western.

### **Ultimate Noise Immunity of Data Transmission by a Channel With Rayleigh Fading at Optimal Non-Coherent Reception of Orthogonal Coded Signals**

937K0094F Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 92 pp 27-30

[Article by V. A. Senderskiy, V. V. Stokov; UDC 621.391.037.372]

[Abstract] The ultimate noise immunity of data transmission by a channel with Rayleigh fading for optimal non-coherent reception of orthogonal coded signals is analyzed. In real systems the transmission is carried out along channels with signal fading whose character for most common channels is described by the Rayleigh distribution. The ultimate noise immunity of a channel with fading is determined by the lower boundary (limiting value) of mathematical expectation of signal-to-noise in the signal transmission channel (modulator output - demodulator input) with a specified accuracy of the source signal reconstruction at the receiving end of the communication line. This lower boundary can be determined by the coding theory applicable to transmission of messages along a noisy channel with a specified accuracy of reconstruction. Normalized transmission capacity of coded signal by  $m$ -th symmetrical and a continuous channel was examined. It was demonstrated that with  $m$ -th noise immune coding in a channel with Rayleigh fading, a significant energy gain can be obtained, compared

to the familiar data transmission method by orthogonal signals. Figures 6, references 9: 5 Russian, 4 Western.

### **Application of Convolution Coding to Increase the Noise Immunity of Single-Band Signal Conversion Devices**

937K0094H Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 92 pp 39-42

[Article by S. L. Shutov; UDC 621.391.23.037-372]

[Abstract] Application of convolution coding for increasing the noise immunity of single-band signal conversion devices was examined. Optimal decoding of the received signal can be made using the Viterbi algorithm. A systematic convolution coder of a single-band signal was developed. The theoretical aspects as well as the verification of some parameters were conducted by imitation modeling. Comparative modeling was performed for coded and uncoded transmission systems at an identical information rate. Practical testing was also made of the efficiency of the convolution method for improving the noise immunity of the single-band signal conversion devices. Compared to the uncoded signal, a gain in the noise immunity of up to 3 dB can be obtained with application of this coder together with the Viterbi decoder. Figure 7, references 8: 2 Russian, 6 Western.

### **Fiber Optic Communication Lines: Scale and Direction of Development**

937K0078A Moscow ELEKTROSVYAZ in Russian  
No 9, Sep 92 (manuscript received 31 Nov 91) pp 2-6

[Article by I. I. Grodnev; UDC 621.395.315]

[Abstract] The need for faster and greater volumes of information transmission, which can be achieved with optical cables, is recognized. The current state of installation of optical cables in Russia and plans for the future are outlined. Russia, Denmark, Japan, the US, Italy, and other nations will participate in the construction of the Trans-Siberian Optical Line, about 17,000 km long. Foreign achievements are outlined. The characteristics of new types of optical cables are discussed and given in a table. Measures taken to preserve the integrity of cables laid in the ground and in water are described. The development of the second generation of fiber optical transmission systems is discussed. Improvements over old cable systems are described. Advances in the production, construction, and use of fiber optic communications lines are presented and difficulties faced in the construction of the lines (i.e., faulty materials) are addressed. Statistical data from the use of optical cables in Moscow is presented. For example, the laser is the most vulnerable element, causing 42 percent of failures; semiconductor elements are responsible for 18 percent of breakdowns. Prospects for the development of fiber optic communications are noted. The problems which

must be solved before fiber optic systems and communication lines can be introduced are enumerated. Tables 2; references 7 (Russian).

### Prospects for International Collaboration in the Design of Optical Communication Lines

937K0078B Moscow ELEKTROSVYAZ in Russian  
No 9, Sep 92 (manuscript received 31 Nov 91) pp 6-7

[Article by V. N. Spiridonov, A. Yu. Tsym; UDC 621.315.2]

[Abstract] There are advantages for all sides in a collaboration to introduce optical communication lines in Russia. Russia gains faster development of communication networks, and the US and Europe gain a new market for products and services. Many of the problems facing the collaboration are associated with lack of knowledge of each other. The conditions for the introduction of optical cables for communication differ. The US and Europe already have universal telephone service and are meeting greater needs. Russia does not yet have telephone service in all regions, and remote regions have a limited need for services. However, digitization of networks is critically needed for information services. The use of optical cables in the Trans-Siberian and Trans-European lines will better integrate Russia into the world economy. A formula is presented to calculate the effectiveness of electric and fiber optic lines, and the conditions for the effective use of optical cables are discussed. Key features of the cooperation are enumerated: 1) sharing of experience and developments; 2) joint work on the creation of specific international communication lines; 3) foreign investment in the creation of internal networks of wire communications; 4) creation of joint stock companies to finance projects in Russia; 5) exchange of findings and joint research. Tables 2; references 2: 1 Russian, 1 Western.

### Optical Fibers for Sensors

937K0078C Moscow ELEKTROSVYAZ in Russian  
No 9, Sep 92 (manuscript received 22 Jan 92) pp 7-8

[Article by S. I. Ivanov, B. N. Rubtsov, B. S. Solov'yev; UDC 621.391.2:535.8]

[Abstract] Optical fibers can be used in four components of fiber optic sensors: the sensitive element, the fiber optic communication line, the coupler, and the polarizer. The former two are used in all fiber optic sensors, the latter two in phase and/or polarization fiber optic sensors. The development of optical fibers for the sensitive element is the most critical problem in the creation of fiber optic sensors, and is dependent on the purpose of the sensor, the type of signal, and its spectrum, as well as the conditions of use of the sensor. This article establishes the interrelations between the basic parameters of optical fibers and fiber optic sensors. A great deal of attention should be concentrated on matching the specifications of the optical fibers to the specifications of the

sensitive element of the sensor. The type, material, design, and purpose of the sensor are specifications which should be considered. In analyzing the results of the use of optical fibers in fiber optic sensors, the authors classify the optical fibers according to their use in the four components of a fiber optic sensor, detail the composition of materials and design features of the optical fiber for these components, expand the set of parameters of fiber optic sensors, increase the lists of purposes of fiber optic sensors, and indicate the parameter measured by the sensor. The set of main parameters of the fiber optic sensor must be expanded in order to compare the characteristics of sensors (metrological, design, use, and economical features) designed for different purposes. A table indicates the parameters of different forms of matter measured by a fiber optic sensor. Tables 2; references 13: 8 Russian, 5 Western.

### Evaluation of the Effect of External Electromagnetic Fields in the Selection of the Design of an Optical Cable With Metal Elements

937K0078D Moscow ELEKTROSVYAZ in Russian  
No 9, Sep 92 (manuscript received 21 Dec 90) pp 11-13

[Article by E. L. Portnov, L. G. Rysin, Yu. T. Larin; UDC 621.316.9]

[Abstract] There are two types of optical cables: those containing metal elements and completely dielectric cables (without metal). The former exhibit a high level of mechanical durability and moisture resistance. Copper conducting wires can be used to supply power to line regenerators, but they are susceptible to electromagnetic effects (thunderstorms) and are heavy and thick. The dielectric cables are immune to electromagnetic effects and corrosion, but are not as mechanically durable, less moisture resistant, and are susceptible to damage by rodents. It is difficult to trace the routes of dielectric cables, and an independent power supply is required for the regenerators. The pros and cons of the use of both types of cables must be weighed and the optical configuration of metal elements inside the cable must be determined, as well as limits on use and cabling in various environmental conditions. Six types of optical cables are examined in this article. The most durable, most homogeneous, best protected, and weakest cable designs are determined. The cross sections of the six types are shown. Specifications are determined for all six cable types. Recommendations are made to improve the specifications, for example, replacing a sheath of steel wires with an aluminum sheath decreases the effect of an external field on the copper wire in the cable by a factor of 1.54. Figures 2; tables 3; references 8 (Russian).

### Grouping of Fiber Lightguides in the Mounting of Delivery Lengths of Optical Cables

937K0078E Moscow ELEKTROSVYAZ in Russian  
No 9, Sep 92 (manuscript received 20 Dec 91) pp 17-18

[Article by V. B. Katok, K. P. Naumenko; UDC 621.372.8]



[Abstract] In real optical cables, fiber lightguides have differing coefficients of attenuation and passbands. This is due to various random factors: inhomogeneities in the construction of the optical fiber, impurities in the core and sheath materials, fluctuations in the microbends of optical fibers when they are mounted in the cable and laid in the ground, inhomogeneities in the optical fiber compounds, and fluctuations in the index of refraction, which create deviations from the optical profile. Relative deviations in attenuation from average values along delivery lengths are usually 30-50 percent, which is about an order of magnitude greater than in common coaxial cables. The relative deviations of dispersion from average values in gradient lightguides may reach 50-80 percent. In the mounting of delivery lengths of optical cable with "light to light" connection of the optical fibers, the absolute difference between the attenuation in line segments may reach 6 dB. Thus, in the construction of fiber optic communication lines one must group fiber lightguides. This article presents a method of grouping (when delivery lengths of optical cables are connected and laid in the ground) which provides a minimum scatter of attenuation between line segments in a given cable. The algorithm is implemented on a DVK personal computer. The program is written in BASIC and works in interactive mode. The initial data are the number of delivery lengths and fiber lightguides in the optical cable, the number of drums for each delivery length, and the attenuation of each delivery length. The output indicates the optimal grouping and the total attenuation. Tables 2; reference 1 (Russian).

#### Method of Evaluating the Quality of Packet Speech Transmission in Integrated Services Digital Networks

937K0078F Moscow ELEKTROSVYAZ in Russian  
No 9, Sep 92 (manuscript received after revision 27 Feb 92) pp 31-33

[Article by G. V. Gorelov, N. A. Kazanskiy, O. N. Lukova; UDC 654.147.2]

[Abstract] Packet speech transmission is a type of traffic with rigid requirements on the time delays of the transmission of messages in real time. Exceeding the acceptable delay values leads to losses of packets and worsening of the quality of speech transmission. This article presents a method of evaluating the quality of packet speech transmission using the criterion of intelligibility based on calculation of the energy spectrum of the speech signal, considering the effect of rejection of packets due to time delays and the noise of quantization and digitization. The method makes it possible to evaluate the characteristics of the quality of communication in networks with packet speech transmission. Examples of the use of the method are given. The quality of intelligibility depends on the effect of radio-like probability-time characteristics of digital communication networks. This method can be used for existing networks or for those under development. Figures 5; table 1; references 8: 5 Russian, 3 Western.

#### Circuitry of Heat Protection Units in Power Analog Integrated Circuits

937K0078G Moscow ELEKTROSVYAZ in Russian  
No 9, Sep 92 (manuscript received 11 Dec 91) pp 40-41

[Article by A. B. Isakov, V. G. Manzhula, Yu. M. Sokolov; UDC 621.316.722]

[Abstract] In power analog integrated microcircuits (voltage stabilizers, power amplifiers, microcircuits which control pulsed sources of secondary power, etc.) heat protection units must be used which completely shut off the device when the chip reaches the maximum permissible temperature. This substantially increases the reliability and life of power microelectronic analog devices. This article is devoted to the design of high-quality heat protection devices which are schematically integrated with the units which assign the static mode and which are intended for use at a wide range of input voltages. This article also discusses the development of engineering methods of designing these units. The method presented here was used in the design of the K142YeN12 series semiconductor integrated stabilizer. Units with a nonhysteresis and hysteresis characteristic are examined. Figures 2; references 2 Russian.

#### Local Computer Network

937K0075A Moscow VESTNIK SVYAZI in Russian  
No 9, Sep 92 p 8

[Article by L. Turovskaya]

[Abstract] The local computer network (LVS) being developed at the Production Association of the Moscow Urban Telephone Network in order to manage fast and efficient network operation and eliminate head enterprise staff errors is described. The network comprises a group of computers in various departments and services, each linked to the data bus through a network interface board. Network capabilities are described. The network concept originates at the automatic control system design department which began working on its development three years ago under the leadership of I.I. Brodyanskiy. Implementation and tests of electronic mail was expected by the end of 1992. A staff training program is outlined.

#### Telekom: First Step in Russia

937K0075B Moscow VESTNIK SVYAZI in Russian  
No 9, Sep 92 p 9

[Article by L. Vaskin]

[Abstract] The opening of the first office of the Deutsche Bundespost Telekom—the largest telecommunications company in Europe—in Moscow headed by Mr. Dietrich Westendorp who has accumulated extensive experience working in other countries is reported and the tasks facing the new bureau in improving the telecommunication infrastructure inside Russia and in the republics of

the former Union are outlined. The agreements signed by the company for setting up a videoconferencing service between Russia and Germany is mentioned and the opinion of Helmut Rikke—a member of the board of directors—about the outlook for future cooperation is quoted. Figures 1.

### Planning Under Conversion Conditions

937K0075C Moscow VESTNIK SVYAZI in Russian No 9, Sep 92 pp 26-27

[Article by P.T. Marchenko]

[Abstract] The original intent of the conversion program (a transition from military to civilian production) is examined and compared to the actual situation in the country and the need to distinguish between the conversion process per se and mere reduction in military production is stressed. The lack of proper legislation governing conversion is mentioned and it is stressed that a sound economic and scientific concept of conversion must still be developed. It must specifically outline the place of conversion in the development of the national economy, its goals and tasks, and possible ways of achieving them. The importance of notifying the plants and plant personnel about anticipated cancellation of government military procurement programs and the social impact of this step are assessed and the conclusion is drawn that the conversion process calls for detailed and sound planning. In the face of constantly shrinking military purchases by the government, the Ministry of Defense (MO) must develop a constructive relationship with the industry. Should military production reductions be sudden, all compensation issues must be resolved in the framework of contractual relationships.

### Outlook for Using Ink Jet Printers

937K0075D Moscow VESTNIK SVYAZI in Russian No 9, Sep 92 pp 34-35

[Article by N.V. Kasatkin, M.M. Korolkov, Postal Communication Scientific Research Institute]

[Abstract] The shortcomings of impact printers and the advantages of contactless and noiseless printing methods prompted an examination of the outlook for using ink jet printers. The design and operating principles of such ink jet printers is considered and schematic diagrams of the process are cited. The high speed and good image quality of the method are noted and prototypes of ink jet printers developed at the Postal Communication Scientific Research Institute (NIIPS) are described. One such thermal ink jet marking device (UTSM) is capable of printing the address on newspapers and magazines passing the printer at a 1.5 m/s speed. The process of automatic data recording and logging development is divided into three stages; the process is illustrated using the example of newspaper transmission directly to subscribers in remote areas over broadcast networks with subsequent printing on location using specialized ink jet

printers. The economic impact from implementing this procedure is assessed. It is noted that such a system, referred as the TV inform, has been conceptually developed; the only thing missing is the dedicated printer for its implementation. Figures 2.

### Main Directions of Development of Ukrainian Fuel and Energy Complex

937K0133A Kiev TEKHNIЧЕСКАЯ ELEKTRODINAMIKA in Russian No 6, Nov-Dec 92 (manuscript received 19 Jun 92) pp 3-11

[Article by A. K. Shidlovskiy, academician, Ukrainian Academy of Sciences; A. S. Grigoryev, candidate of engineering sciences (Institute of Electrodynamics, Ukrainian Academy of Sciences, Kiev); B. Z. Piriashvili, candidate of economic sciences (SOPS [Council for the Study of Productive Resources], Kiev); and M. I. Mints, doctor of economic sciences (Institute of Problems of Energy Conservation, Ukrainian Academy of Sciences, Kiev)]

[Abstract] Fuel and electric power requirements for the period up to 2005 were estimated. Coal reserves were estimated to be sufficient for 280 years. However, an increase in imports of natural gas and oil to 130 billion cubic meters and 58 million tons, respectively, in 2005 was estimated. Natural gas was recommended to be used to fuel an additional 4 million KW generating capacity needed in the period from 1993 to 1995. No increase in the nuclear-fueled capacity of 10.8 million KW was recommended. To reduce dependency on imports, a policy of energy conservation and use of solar and wind energy was recommended. Development of the latter through joint projects with foreign firms was encouraged. References 4: 3 Russian, 1 Western.

### Role of Correspondence Between Enterprise Electric Power Supply System Classes and Their Mapping Functions

937K0133B Kiev TEKHNIЧЕСКАЯ ELEKTRODINAMIKA in Russian No 6, Nov-Dec 92 (manuscript received 29 Sep 92) pp 81-85

[Article by A. F. Bondarenko, candidate of engineering sciences (KPI [Kiev Polytechnic Institute], Kiev); UDC 621.316.728:621.31.004.18]

[Abstract] Assessing the problem of optimizing electric power consumption conditions for various sets of enterprise electric power supply systems varies in complexity. Formal or informal methods for making comparative assessments of them as objects of management and modeling according to the factor of electric power consumption are lacking. The capability and advisability of developing methods to assess the quality of control of the effectiveness of enterprise electric power supply systems according to the factor of electric power consumption by the introduction of a fuzzy-set measure was substantiated. Suggestions for implementing the results as criteria

for developing highly efficient electric power consumption control systems were made. The results were also viewed as persuasive means for power engineer managers to use in selecting control systems which best match the needs of a specific industry. Uncertainty was reduced by raising the adequacy of means of optimization of electric power consumption conditions. This allowed controlling system effectiveness. It was shown that controlling the effectiveness of the set of enterprise electric power supply systems according to the factor of electric power consumption is a function of the level of qualitative and quantitative sophistication of the problem-oriented knowledge base making up the set of control subsystems and the modern hardware and information technologies used to implement the systems. References: 5 Russian.

### Construction of Multilayered Electrooptic Structures

937K0129A Novosibirsk AVTOMETRIYA in Russian  
No 4, Jul-Aug 92 pp 47-57

[Article by S. V. Piskunov; UDC 621.382]

[Abstract] Using a distributed computation model, called algorithm of parallel substitutions, a method is developed for transition from a two-dimensional computing structure to a multilayered (three-dimensional) structure, which in essence realizes an identical signal processing algorithm. It is demonstrated that when employing the three-dimensional structure within the framework of electrooptic circuit engineering, this method allows to select the complexity of an individual cell and the topology of electric connections between the cells located in the same layer, as well as to transfer a significant part of electric connections between the cells of the two-dimensional structure to the optical interlayer contacts of the three-dimensional structure. An electrooptic computing device can be constructed by employing a three-dimensional structure, where each layer represents a microelectronic LSIC which can transfer signals to the other layers. Figures 9, references 13: 7 Russian, 6 Western.

### Application of Waveguide Optics for Construction of Functional Elements of Optical Digital Computers

937K0129B Novosibirsk AVTOMETRIYA in Russian  
No 4, Jul-Aug 92 pp 62-65

[Article by S. V. Sokolov; UDC 671.327.1]

[Abstract] Several samples are examined for constructing fundamental elements of optical digital technology based on a combined application of waveguide optics and optical bistable elements. This includes an optical trigger and an optical binary adder. Operation of the devices is described and their functional block diagrams are provided. The possibilities of a practical synthesis of optical

digital computers based on the examined optical functional elements is discussed. The central issues here revolve around questions of the feasibility of information and engineering interfacing of these elements with other optical functional elements of digital computers. In this situation the possibility of information interfacing is provided by an exact correspondence of the optical signal's potential level, corresponding to "0" or "1", at the inputs and outputs of the proposed elements. The principal advantage of the examined functional circuits for the optical digital computers, compared to the existing, lies in their simplicity and a purely optical construction requiring no additional application of electronic control circuits. Figures 2, references 2 Russian.

### Developments of Powerful CO-Lasers in Russia

937K0128A Moscow KVANTOVAYA ELEKTRONIKA  
in Russian Vol 20, No 2, Feb 93 pp 113-122

[Article by A. A. Ionin, Russian Academy of Sciences Physical Institute, Moscow; UDC 621.373.826.038.823]

[Abstract] A review is made of CO-laser studies and developments in Russia. Various types of continuous, pulsed and pulse-periodic CO-laser have been developed in different laboratories. Continuous sealed-off water-cooled CO-lasers with 5-10 W generation power, excited by self-sustained electric discharge, are successfully employed for manufacturing of electronic instruments and in medicine. The generation power of a fast-flow continuous cryogenic CO-laser with a self-sustained discharge can be as high as 1 kW. With application of electroionization (EI) pumping it was possible to develop pulsed EI CO lasers with energy up to 1 kJ, and to design continuous and pulse-periodic EI CO-lasers with 10 kW power and efficiency of about 40 percent. Studies of pulsed EI CO-lasers constitute a scientific base for development of CO-laser systems of the master oscillator - amplifier type, and pulse-periodic CO-lasers. A CO-laser system has been developed with radiation energy of about 200 J, and  $2 \times 10^{-4}$  rad angular divergence of radiation. Requirements for effective amplification in an active medium and propagation in the atmosphere of multifrequency CO-laser radiation pulses with different spectral and temporal properties have been formulated. A supersonic EI CO-laser with a peak power of about  $10^5$  W and a pulse-periodic 10 kW EI CO-laser with a subsonic pumping, generating 100 J pulses at a repetition rate of up to 100 Hz have been developed. Non-standard methods of excitation and cooling of the active medium of powerful CO-laser, among them EI CO-lasers with injection of laser mixture in a liquid state and lasers with nuclear ionization of the active medium are also studied. Figures 14, references 35: 25 Russian, 10 Western.

### Parametric Frequency Transformation of a Powerful Pulse in a $\delta$ -Junction System

937K0128B Moscow KVANTOVAYA ELEKTRONIKA  
in Russian Vol 20, No 2, Feb 93 pp 135-136

[Article by S. V. Sazonov, Russian Academy of Sciences, Pacific Ocean Oceanologic Institute, Far Eastern Military District, Vladivostok; UDC 535.2:535.33]

[Abstract] Magnetic-dipole interaction of circularly polarized ultra-short pulses (USP) with a two-level  $\delta$ -junction, formed by a super-fine splitting of the electron state is examined and the feasibility is demonstrated of parametric generation of two high-frequency spectral components, corresponding to the nutation in the super-strong field. By gradual variation of the pulse intensity, the USP frequency at the output of the system of  $\delta$  junctions can be continuously transformed. In the case of the  $\pi$ -junction, a discrete set of harmonics of the  $\omega$  is generated at the output, (where  $\omega$  is the angular rotation frequency of the magnetic field vector), while as the USP power increases, the spectral intensities of higher and higher harmonics are increased. There are no harmonics in the system of  $\delta$ -junctions; here, with increased USP power two generated spectral components  $\omega_{1,2}$  are continuously shifted into the region of higher frequencies. References 6 Russian.

#### Numerical Simulation of Recombination X-Ray Lasers

937K0128C Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 20, No 2, Feb 93 pp 137-141

[Article by V. Yu. Kaynov, V. M. Linnik, D. B. Maslennikov, V. D. Urlin, Russian Scientific Research Institute of Experimental Physics, Arzamas-16, Nizhniy Novgorod District; UDC 621.373.826:621.3.029.76]

[Abstract] A model of recombination X-ray lasers was developed and computations of the gas dynamics of plasma with non-equilibrium diffusion of thermal radiation, which includes the irradiation stage of the laser target was performed. Determination of the  $H_{\alpha}$ -radiation power of the entire face of the plasma cylinder and determination of the corresponding gain constitute the particular features of these computations, in addition to modeling the stage of laser impact on the target, correct accounting of the Liman lines reabsorption and fine splitting of the C-VI ions level. This allowed to compare the computed values with the experimental data obtained with the laser "Vulcan" apparatus at the Rutherford Appleton Laboratory. The gas dynamic computations were made with approximation of cylindrical symmetry of radiation and plasma dispersion according to the SND program with perfected kinetics of the ions recombination. Seven levels of H-like ions were effectively accounted for in this study. When computing the energy liberation it was assumed that the absorption of the laser radiation occurs according the bremsstrahlung mechanism with release of the entire energy reaching the radius, where the electron density is equal to the critical value. Figures 4, references 10: 4 Russian, 6 Western.

#### Feasibility of Increasing the Efficiency and Brightness of Powerful Laser Radiation by Nonlinear Summation of the Train of Nanosecond Pulses

937K0128D Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 20, No 2, Feb 93 pp 172-174

[Article by I. G. Zubarev, L. L. Losev, S. I. Mikhaylov, Yu. V. Senatskiy, V. G. Smirnov; UDC 621.373.826]

[Abstract] A laser system design is proposed in this article, which makes it possible to add the energy of the pulse train propagating through the amplifier stages along a single optical path, i.e. to add the energy of pulses separated only in time. The feasibility of increasing the system efficiency and increasing the brightness of radiation at the adder output is demonstrated and the results of computations of neodymium laser - SRS adder system with 1 kJ output energy and 20 x 20 cm beam aperture are provided. Figures 2, references 5: 3 Russian, 2 Western.

#### Excitation of Eximer KrF-Laser by an Optical Discharge in the Field of IR Laser Radiation

937K0121A Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 20, No 1, Jan 93 pp 39-44

[Article by V. I. Igoshin, S. Yu. Pichugin; UDC 621.373.826.038.823]

[Abstract] The feasibility was analysed of the  $F_2$ -Kr-He-mixture excimer laser excitation by an IR laser pulse during development of optical discharges in the active medium. Numerical computations were conducted for the mixture  $F_2$ :Kr:He = 3:75:1500 and 4:200:1500 mm mercury column, excited by 20-150 ns laser pulses at the wavelength of 2.8 and 10.6  $\mu$ m. Propagation of the excitation pulse in the  $F_2$ -Kr-He medium was investigated taking into account the absorption of the IR laser radiation by electrons of the optical discharge plasma. It was demonstrated that when focusing the IR radiation by an optical system with a focal distance of 1-30 m and a peak intensity at the input to the laser medium on the order of 10 ( $\lambda=2.8 \mu$ m) and 1 GW/cm<sup>2</sup> ( $\lambda=10.6 \mu$ m), pumping is possible of the KrF-laser by the IR radiation with about 5 percent efficiency. Figure 1, table 4, references 6: 5 Russian, 1 Western.

#### Features of the Pulsed Dye Laser Radiation Spectrum With Wide-Band Injection

937K0121B Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 20, No 1, Jan 93 pp 62-75

[Article by S. V. Pavlov, M. N. Polyanskiy, N. S. Ryazanov; UDC 621.373.826.038.824]

[Abstract] The process of forming the spectral radiation characteristics of pulsed dye laser when it is injected into the resonator of a wideband laser radiation was investigated theoretically and experimentally. For the dye laser with a lamp pumping and a non-selective resonator it was experimentally demonstrated that the executing laser generates bright-line spectrum radiation with frequencies of maximum intensity located in the axial mode frequency coincidence regions of the initiating and the executing lasers. Equations were derived for the efficiency of the initiation process and the initial radiation phases of multimode generation, developed as a result of the initiating laser radiation of the axial modes. A functional relationship exists between these values and



the frequency difference of the nearest modes of the initiating and executing lasers and its non-saturated amplification. It was demonstrated that the generation of the executing laser is developed at the mode which is nearest to the frequency of the initiating radiation. The experimental results well agree with the calculations. Figures 3, references 5 Russian.

### **Shock Waves in Superconducting Communication Lines and High-Speed Transmission of Information**

937K0113A St. Petersburg PISMA V ZHURNAL  
TEKHNICHESKOY FIZIKI in Russian Vol 18, No 14,  
Jul 92 pp 8-13

[Article by N. V. Fomin]

[Abstract] It is demonstrated that a non-linear mode of signal propagation with formation of shock wave type self-modeling solutions is possible in superconducting microwave communication lines. The convection term in the equation which generalizes the London equation for superconducting current, and which is analogous to the convection term in hydrodynamics, acts as a source of the required non-linearity. This effect is of a practical interest when strongly delaying systems are employed, where a nonlinear kinetic inductance dominates the linear geometrical inductance. References 7: 5 Russian, 2 Western.

### **Acoustical Antennas With Distributed Parameters Made of Optical Fiber**

937K0113B St. Petersburg PISMA V ZHURNAL  
TEKHNICHESKOY FIZIKI in Russian Vol 18, No 14,  
Jul 92 pp 18-22

[Article by M. P. Petrov, A. A. Fotiadi, RAS Institute of Physics and Engineering, St Petersburg]

[Abstract] A model of a phase type sensor using fibers with a specified distribution of sensitivity coefficient to the acoustic pressure along its length is examined in this article. Application of the distributed effect principle in acoustic fiber-optic sensors (FOS) makes it possible to combine the signal reception function with analysis of its spatial spectrum. An equation is derived for forming the pattern of the phased acoustic receiver by selecting the geometry of the optical fiber orientation in space, as well as by selecting the fibers with an appropriate distribution. Fibers with distributed parameters represent a new, not yet tried class of fiber sensitive elements. Their application with FOS allows designing selective receivers and antenna systems for recording planar, spherical acoustic waves, as well as wave fronts of a more complex configuration. Figures 3, references 3: 1 Russian, 2 Western.

### **Ozone-Electromagnetic Prognostication of Earthquakes**

937K0113C St. Petersburg PISMA V ZHURNAL  
TEKHNICHESKOY FIZIKI in Russian Vol 18, No 14,  
Jul 92 pp 26-28

[Article by V.V. Lasukhov]

[Abstract] The electrization phenomenon of newly formed surfaces when crystals, including geomaterials are being deformed and destroyed, is discussed. The material's electrization occurs because of breaking off ionic bonds with motion of cracks in the material due to motion of charged dislocations, adhesion or electrolyte phenomena. The surface charge density of separated charges, depending on the type of material, lies within a wide range ( $10^{-10}$  -  $10^{-2}$  C/m<sup>2</sup>), so that when the surface charge density is on the order of  $10^{-5}$  C/m<sup>2</sup>, an electric break-down of gas gap between the edges of the surface cracks is possible and can accompany generation of ozone and monatomic oxygen. An equation is derived for modulus of radial component of the electric field in a spherical near-ground waveguide as a function of the atmospheric radiator power, wavelength, horizontal distance between source and the observation point, conductance of the near-ground layer, electron density in the atmosphere and the atmosphere's altitude. It is shown that changes in the electron density and conductivity will cause changes in the electric field and can serve as indicators of processes for impending earthquakes. References 7 Russian.

### **Soliton Switching in a Non-Linear Directional Coupler With an Active Element**

937K0113D St. Petersburg PISMA V ZHURNAL  
TEKHNICHESKOY FIZIKI in Russian Vol 18, No 14,  
Jul 92 pp 29-32

[Article by F. Kh. Abdullayev, S. A. Darmanyany, V. I. Goncharov]

[Abstract] It was previously demonstrated that it is possible to control energy switching of optical pulses between propagation channels in non-linear directional couplers (NLDC), and optimal for this process characteristic values of linear linkages and soliton's parameters were determined. For many applications a steeper slope is desired for the switching characteristics - the relationship of the pulse output parameters as a function of the input parameters. This would produce a more effective energy switching at the coupler output with smaller changes of the signal input power. A coupler is proposed for this purpose, where because of active additives, a pulse amplification takes place in one of the channels. The performance of such an NLDC was examined and numerical experiments were performed for studying the effects of energy switching of solitary pulses between the NLDC channels. The experimental results indicate that the application of optical amplification in fiber optical



couplers improve the amplitude and energy characteristics of optical switching. Figures 2, references 6: 2 Russian, 4 Western.

### Generation of Electromagnetic Waves by Metal With Current in a Magnetic Field

937K0113E St. Petersburg PISMA V ZHURNAL TEKHNIЧЕСКОY FIZIKI in Russian Vol 18, No 14, Jul 92 pp 46-50

[Article by A. B. Rinkevich, M. V. Ponomareva, V. V. Ustinov]

[Abstract] Generation of electromagnetic wave pulses due to current pulses was detected in a meander line made of pure aluminum or tungsten. This effect is observed at low temperatures and in a strong magnetic field. There is a correlation between the generation effect and transient phenomena with propagation of the electromagnetic waves. In this study, generation was recorded at much lower drift velocity of electrons than sound velocity and velocity of delayed electromagnetic waves. Generation of high-frequency electromagnetic wave pulses was recorded for the entire frequency range from 1.2 to 2.2 GHz used in the experiment. Results of the experiments are provided and causes for the observed generation phenomena are discussed. Figures 2, references 9: 7 Russian, 2 Western.

### Adsorption-Sensitive Diode Made of Porous Silicon

937K0113F St. Petersburg PISMA V ZHURNAL TEKHNIЧЕСКОY FIZIKI in Russian Vol 18, No 14, Jul 92 pp 57-59

[Article by V. M. Demidovich, G. B. Demidovich, Ye. I. Dobrenkova, S. N. Kozlov, Moscow State University]

[Abstract] An attempt was made to develop a gas sensor using porous silicon based on the principle of measuring the reverse current of planar p<sup>+</sup>-n-junction with a porous external p<sup>+</sup>-layer. The experimental structures consisted of large area planar diodes with a highly doped p<sup>+</sup>-layer. Transformation of the solid crystal p-silicon into a porous one was made by an electrochemical etching method. The nature of the reverse current characteristics of the studied structures as a function of voltage indicate that generation of minor charge carriers in the depletion layer plays the determining role in formation of the reverse current. Figures 2, references 6: 5 Russian, 1 Western.

### Miniaturization Method of the Elements of Complementary MIS Base of VLSI Circuits

937K0131A Novosibirsk AVTOMETRIYA in Russian No 5, Sep-Oct 92 pp 42-54

[Article by A. G. Bogdanov, V. I. Koldyayev, V. Ye. Malak, I. G. Neizvestnyy; UDC 621.315]

[Abstract] Problems of practical miniaturization of the element base of complementary metal-insulator-semiconductor (CMIS) VLSI circuits are discussed and the familiar methods of scaling the MIS transistors are examined. A miniaturization method is described of the element base of the CMIS VLSI circuits, which includes the scaling procedures, and the "through modeling" system of the elements and the VLSI circuits manufacturing technology for the element's optimization. With this method new design ideas and technologies can be incorporated in a natural way into the element base and technological processes of the VLSI circuit manufacturing. A generalized vertical cross section construction of metal-insulator-semiconductor transistors, which employs four doped layers is proposed, and optimization requirements are analyzed for each layer. This construction satisfies the requirements of high-quality technology. Practical results are obtained of miniaturization of the CMIS VLSI circuit element base in 2-0.7  $\mu\text{m}$  design range, which indicate that it is impossible to employ quantity CMIS technology with n<sup>+</sup>-polysilicon gates for a design range smaller than 1  $\mu\text{m}$ . Figures 6, references 28: 6 Russian, 22 Western.

### Optimization of Spectral Sensitivity of Space-Time Light Modulators on Selenide Crystals

937K0131B Novosibirsk AVTOMETRIYA in Russian No 5, Sep-Oct 92 pp 65-67

[Article by V. A. Gusev, S. I. Demenko; UDC 535.215:535.241.13:537.228]

[Abstract] A method of directed changes of spectral photo-response of selenide crystals for the purpose of shifting the maximum into the yellow-green spectrum region is described. A "PRIZE" type space-time light modulator (STLM) structure with a shifted spectral sensitivity operating in a reflection mode was fabricated from selenide crystals. One of the device's substrates was made of a fiber-optic plate, which allowed the elimination of the projection optics between the electron-optic transducer screen and the modulator. Tests were carried out to determine the fundamental characteristics of the modulators. Figures 2, references 3 Russian.

### Study of Doping Profiles and Mobility in Silicon-on-Insulator Structures Obtained by Laser Zone Recrystallization

937K0117A Moscow MIKROELEKTRONIKA in Russian Vol 22 No 1, Jan 93 (manuscript received 23 Oct 91) pp 3-13

[Article by T. Ye. Rudenko, A. N. Rudenko, V. S. Lysenko, A. B. Limanov and Ye. I. Gibargizov; Institute of Semiconductors, Ukrainian Academy of Sciences, and Institute of Crystallography, Russian Academy of Sciences; UDC 621.382.3]

[Abstract] A method for determining the profile of charge carrier drift mobility throughout the thickness of

Si film in silicon-on-insulator [SOI] and silicon-on-sapphire [SOS] metal-oxide-semiconductor [MOS] structures was studied. The method was based on using a structure which was a combination of a depletion type MOS transistor and a gate controlled diode. Samples studied were based on SOI films obtained by laser zone recrystallization of layers of polycrystalline silicon with a thickness of 0.3 to 0.5 micrometers deposited on thermally oxidized Si wafers. Thickness of insulating oxide was 1.0 micrometer. Carrier mobility in the studied SOI films, which contained grain and subgrain boundaries, was constant throughout the thickness of the film, noticeably exceeded mobility in the SOS, was a function of doping concentration and was comparable to mobility in volumetric Si with the same levels of doping. Apparently, the dominant mechanism of carrier dissipation at room temperatures in SOI films based on recrystallized polysilicon was dissipation on ionized additives. Dissipation at subboundaries showed a slight effect. Structural defects in the SOS played a leading role. To obtain a given concentration of doping, the modes of doping used in volumetric Si and SOS technology cannot be used for developing elements based on SOI without corresponding correction. Figures 6; references 14: 5 Russian, 9 Western.

**Using Molecular Beam Epitaxy to Grow Homoepitaxial Layers of Silicon on Surface of Porous Silicon After Low-Temperature Purification in a Vacuum**

937K0117B Moscow MIKROELEKTRONIKA in Russian Vol 22 No 1, Jan 93 (manuscript received 5 Aug 91) pp 19-21

[Article by V. G. Shengurov, V. N. Shabanov, N. V. Gudkova and B. Ya. Tkach; Scientific Research Physical-Technical Institute, Nizhegorod State University; UDC 621.382]

[Abstract] Optical metallography, electronography and electron microscopy were used to study thin (0.5 to 2 micrometers) layers of silicon obtained by molecular beam epitaxy on substrates with porous silicon at a rate of 1 nm/s at  $T = 600$  to  $700^\circ\text{C}$ . The porous silicon substrate surface was purified at  $750^\circ\text{C}$  for 5 to 15 minutes in a flow of silicon atoms with an intensity of  $(2 \text{ to } 8) \times 10^{13} \text{ at/cm}^2 \times \text{s}$  which was created by sublimation of a silicon rectangular chip heated by passage of current. Smooth epitaxial silicon layers with sharp and flat partition boundaries were grown on the porous silicon at a residual gas pressure of  $10^{-7}$  torr. Figures 2; references 9: 1 Russian, 8 Western.

**Effect of Self-Gettering During Formation of Diffused p-n Junctions in Silicon**

937K0117C Moscow MIKROELEKTRONIKA in Russian Vol 22 No 1, Jan 93 (manuscript received 26 Aug 91) pp 22-26

[Article by A. P. Gorban', V. P. Kostylev, V. G. Litovchenko, I. B. Nikolin and A. A. Serba; Institute of Semiconductors, Ukrainian Academy of Sciences; UDC 621.315.592]

[Abstract] This study was aimed at discovering the inherent changes in the generation-recombination characteristics of the near-surface region and body of silicon chips caused by diffusion of phosphorus and boron into the active regions of the devices. Gettering of electrically active additives and defects from the body of the chip into the  $n^+$  region occurred in the process of forming  $n^+$ -p junctions through thermodiffusion of phosphorus with subsequent annealing. Because of this, the recombination parameters of the OPZ [space-charge region] and quasineutral body were improved, but at the same time, recombination in the doped  $n^+$  region increased. On the other hand, the gettering effect of diffusion of boron on the generation-recombination properties of diode  $p^+$ -n structures was not observed in forming p - n junctions. Figures 3; references 10: 4 Russian, 6 Western.

**Effect of Fluorine on Diffusion Stimulated by Radiation, Radiation Hardness, and Threshold Voltages of Metal-Oxide-Semiconductor Structures**

937K0117D Moscow MIKROELEKTRONIKA in Russian Vol 22 No 1, Jan 93 (manuscript received 5 Dec 91) pp 27-29

[Article by A. G. Dugov, S. V. Shiryayev and T. T. Samoylyuk; Solid State Physics Institute, Belorussian Academy of Sciences; UDC 621.382]

[Abstract]  $\text{SiO}_2$ -Si structures obtained by thermal oxidation of KEF 4.5 (100) silicon with layers of dioxide (25.2 to 42.5 nm) were studied by the neutron activation analysis method. MOS structures doped with fluorine were subjected to tests for radiation hardness. Test results showed that in comparison to undoped devices at identical biases of threshold voltages, the radiation dose increased fifty-fold and more to more than  $4 \times 10^5 \text{ Gr}$ . Initial values of threshold voltages of the doped structures were lower by a factor of 1.5 to 2.0 than the undoped while the shape of the C-V curves essentially did not change. This indicated development of a negative charge in the dioxide during ion implantation of the fluorine and that new surface states did not form in the doped structures. Figures 2; 1 table; references 5: 3 Russian, 2 Western.

**Features of Local Process of Etching of Submicron Channels in GaAs**

937K0117E Moscow MIKROELEKTRONIKA in Russian Vol 22 No 1, Jan 93 (manuscript received 3 Sep 91) pp 30-32

[Article by Yu. M. Dikayev; Institute of Radio Engineering and Electronics, Russian Academy of Sciences; UDC 621.315.592:535.421]

[Abstract] The property of deepening of trapezoidal shaped channels with submicron dimensions was investigated. This occurred after removal of the photoresist

mask. The existing relief of the GaAs structure continued to be etched in a solution of  $\text{HCl-KBrO}_3\text{-H}_2\text{O}$  with an increase in channel depth. Channel depth was controlled by measuring diffraction effectiveness of periodic structures. This confirmed the dimensional effect detected earlier. Figures 3; references 4: 2 Russian, 2 Western.

#### **Study of Effect of Structure of Collector Junction on High-Frequency Characteristics of AlGaAs/GaAs Bipolar Heterostructural Transistors**

937K0117F Moscow MIKROELEKTRONIKA  
in Russian Vol 22 No 1, Jan 93 (manuscript received 19 Nov 91) pp 33-40

[Article by S. Ye. Kartashov, V. I. Ryzhiy and G. Yu. Khrenov; Physical Technological Institute, Russian Academy of Sciences; UDC 621.382]

[Abstract] Kinetic modeling was used to analyze the functioning of three transistors with different modifications of the collector junction. Introduction of a  $\delta p^+$  layer into the collector structure led to an increase in the transistor cut-off frequency compared to a BGT [heterojunction bipolar transistor] with a homogeneously doped collector. The use of this layer in the collector reduced cut-off frequency dependency on the collector-base voltage compared to a transistor and collector with an  $i\text{-}p^+\text{-}n^+$  structure. For transistors with a nonhomogeneously doped collector, the determining factor limiting the speed of a heterojunction bipolar transistor is the effective time for transfer of electrons in the collector depletion region for large values of collector voltage and the time associated with the charge of the collector depletion region at small voltages. Figures 5; references 14: 2 Russian, 12 Western.

#### **Transimpedance Integral Operational Amplifiers**

937K0117G Moscow MIKROELEKTRONIKA  
in Russian Vol 22 No 1, Jan 93 (manuscript received 9 Apr 92) pp 47-51

[Article by T. M. Agakhanyan; Moscow Engineering Physics Institute; UDC 621.382]

[Abstract] Analog devices made with transimpedance integral operational amplifiers were compared to conventional types. In speed and frequency, they were no better than circuits made with traditional integral operational amplifiers. The extreme boundary frequencies, computed without considering the shunting effect of resistors and capacitors in the feedback circuit, were 10

to 25 percent lower than in the circuits made with traditional amplifiers. Figures 1; references 8: 3 Russian, 5 Western.

#### **Experimental Josephson Stroboscopic Converter Based on Dual Contact Superconducting Quantum Interferometer**

937K0117H Moscow MIKROELEKTRONIKA  
in Russian Vol 22 No 1, Jan 93 (manuscript received 30 Jan 92) pp 52-60

[Article by V. P. Ahdratskiy and V. S. Bobrov; Institute of Precision Mechanics and Computer Engineering imeni S. A. Lebedev, Russian Academy of Sciences; UDC 621.382]

[Abstract] Operation of a Josephson stroboscopic converter based on a dual-contact superconducting quantum interferometer was studied. The converter functioned as a strobe generator and comparator simultaneously. Numeric analysis showed the converter had high frequency properties especially when Josephson tunneling with high critical current density was used. Experimental study of the operation of a strobe oscillograph, which included a microcircuit with this converter, confirmed the fitness and promise of the latter for measuring high-speed transient processes. Figures 4; references 15: 6 Russian, 9 Western.

#### **Logic Parametric Faults in Combination Structures of VLSI Circuits**

937K0117I Moscow MIKROELEKTRONIKA  
in Russian Vol 22 No 1, Jan 93 (manuscript received 20 Feb 92) pp 61-71

[Article by V. S. Chunayev, now deceased; Institute of Precision Mechanics and Computer Engineering imeni S. A. Lebedev, Russian Academy of Sciences; UDC 621.382]

[Abstract] Logic element circuit operation stability problems were studied. Possible faults occurring because of a change in values of element transfer characteristic parameters were analyzed. Features of compiling tests for monitoring logic parametric faults in combination structures of synchronous LSI circuits were considered. Circuits using emitter-coupled logic elements were analyzed. The introduction of a new indicator for parametric observability into test generation programs which use indicators of observability and controllability in generating test sequences allowed increasing the probability of detecting logic parametric faults in LSI circuits and reducing test generation time and the number of test vectors required. Figures 6; references 2 Russian.

**Comparison of Drift-Diffusion and Kinetic Approaches to Modeling Silicon p-MOS Transistors**

937K0117J Moscow MIKROELEKTRONIKA  
in Russian Vol 22 No 1, Jan 93 (manuscript received  
30 Jan 92) pp 80-86

[Article by M. Yu. Yershov, Yu. V. Yershova and V. I. Ryzhiy; Physical Technological Institute, Russian Academy of Sciences; UDC 621.382]

[Abstract] Two approaches to modeling submicron p-Si MOS transistors were compared. Special software was used for kinetic modeling. The SIMOS program was used for the drift-diffusion model. The drift-diffusion model was found adequate for modeling p-MOS transistors with a channel length greater than 0.4 micrometer. In analyzing volt-ampere characteristics of transistors with a channel length less than 0.2 micrometer, nonstationary effects of transfer had to be taken into account. Ignoring non-local kinetic effects in the drift-diffusion model led to error in computing current drain: about 20 percent for a channel length of 0.1 micrometer. The error decreased as the length increased. A mobility model with an overstated saturation rate value was found to be the simplest method of accounting for nonstationary effects within the scope of the drift-diffusion model in modeling transistors with a small channel length (less than 0.2 micrometer). Figures 5; references 13: 4 Russian, 9 Western.

**Electromotive Force Induced in System of Charge-Coupled Metal-Insulator-Semiconductor Structures When Illuminated Through Modulation of Surface Recombination**

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[Article by A. I. Krymskiy and A. Ye. Kozeyev; Semiconductor Physics Institute, Siberian Department, Russian Academy of Sciences; UDC 537.311.33]

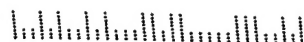
[Abstract] A system of two charge-coupled metal-insulator-semiconductor [MIS] structures was studied under illumination to demonstrate a new capability of inducing barrier electromotive force in the surface region of a semiconductor. Variable barrier emf was induced in an illuminated semiconductor by modulating the rate of surface recombination. Two charge-coupled MIS structures with a counter-pin coating were used to observe recombination emf. Application of a variable signal to a MIS capacitor input led to photo stimulated emf at the MIS structure output. The relationship between the level of excitation in an illuminated semiconductor and the surface potential in the entire range of bends of zones was derived for the first time for a MIS structure from an experiment. The method of measuring low-frequency capacitance of an illuminated semiconductor was found to be free of the effect of the internal active element. Figures 6; references 11: 8 Russian, 3 Western.

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